FINAL REPORT
FOR
MARCORSYSCOM

LOGISTICS VEHICLE SYSTEM (LVS) SIGNATURE DATA

AUTHORIZATION:
CONTRACT NUMBER: N00167-98-C-0017

NATC PROJECT NUMBER 20513

DECEMBER 2002 – JANUARY 2003

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1.0 BACKGROUND

The U. S. Marine Corps Systems Command (MARCORSYSCOM) contracted the Nevada Automotive Test Center (NATC) to obtain signature data for the Logistics Vehicle System (LVS) under contract number N00167-98-C-0017. Infrared, Inc. of Reno, Nevada conducted a thermal analysis of the LVS on 20 November 2002. A sound test of the LVS was conducted on 7 January 2003. Profile data of the LVS was compiled for this report.

2.0 OBJECTIVE

The purpose of this analysis was to acquire supplemental data for the LVSR (Logistics Vehicle System Replacement) Purchase Description. The LVSR Draft ORD and Section 3.4.8 of the Performance Specification dated 10 June 2002 states “Under a tactical configuration, the infrared, audio, visual, and thermal signatures of each variant shall be no greater than the current LVS”. The supporting signature data was obtained under this project.

3.0 VEHICLE

The vehicle used for this analysis was USMC number 561452, Front Power Unit, MK48, NSN 2320-01-177-5167. The Rear Body Unit, MK18A1 was USMC number 563803, NSN 2320-01-392-0293.

4.0 THERMAL IMAGING TEST CONDUCT

The vehicle was parked and not moved for 24 hours. Visual and infrared images were captured prior to operation. The vehicle was driven on the paved test track for one hour with a 22.5 ton payload. Qualitative and quantitative infrared thermal images were completed and a thermal analysis of pre- and post-operation was conducted with a thermal signature comparison of the components.

4.1 Temperature And Conditions

During the infrared survey, the weather was clear with the ambient temperature starting at 23 degrees Fahrenheit and rising to 31 degrees Fahrenheit. To correlate to a 125 degree Fahrenheit ambient temperature, the delta temperature (93.5°F) should be added to the scales in each thermal photograph.

4.2 Equipment

The following equipment was used to conduct this analysis:

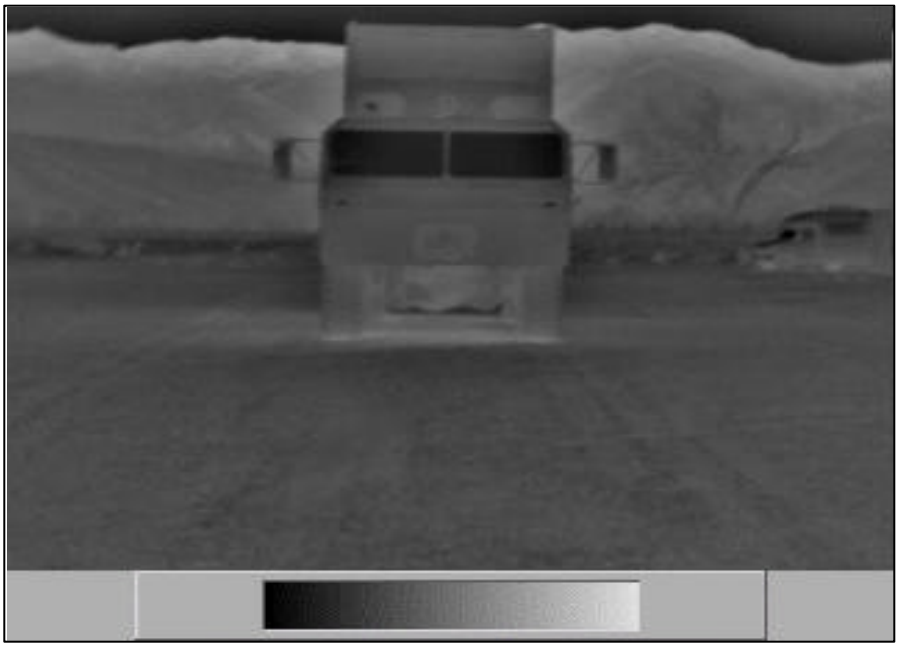
- Raytheon Radiometric 500 D Infrared Camera System
- Raytheon 400 D Infrared Camera System
- Raytek Digital Pyrometer with Laser and Probe
- Image/IR 2000 Infrared Imagine Software

4.3 Infrared Inspection And Report

The infrared and thermographic analysis is incorporated as a part of this report. The LVS location and components were analyzed by utilizing surface temperature differential and by applying an emissivity value of 1.00. Actual temperatures may be determined by applying the specific emissivity value for the components. The temperatures and infrared images were recorded on a PCMCIA disk, and the infrared image analysis was completed utilizing infrared imaging software.

VISUAL IMAGE VEHICLE FRONT

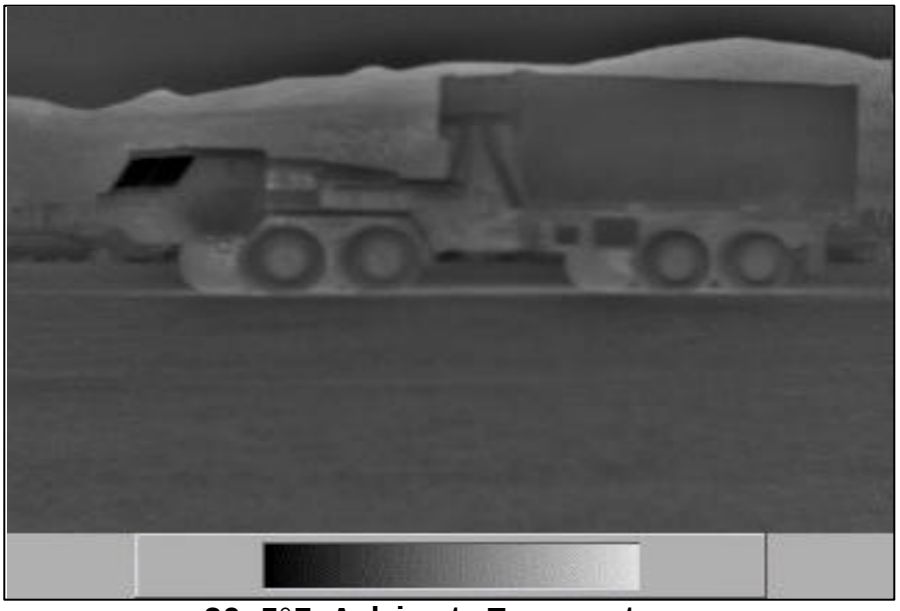
INFRARED IMAGE VEHICLE FRONT



20.5°F Ambient Temperature

VISUAL IMAGE VEHICLE DRIVER SIDE

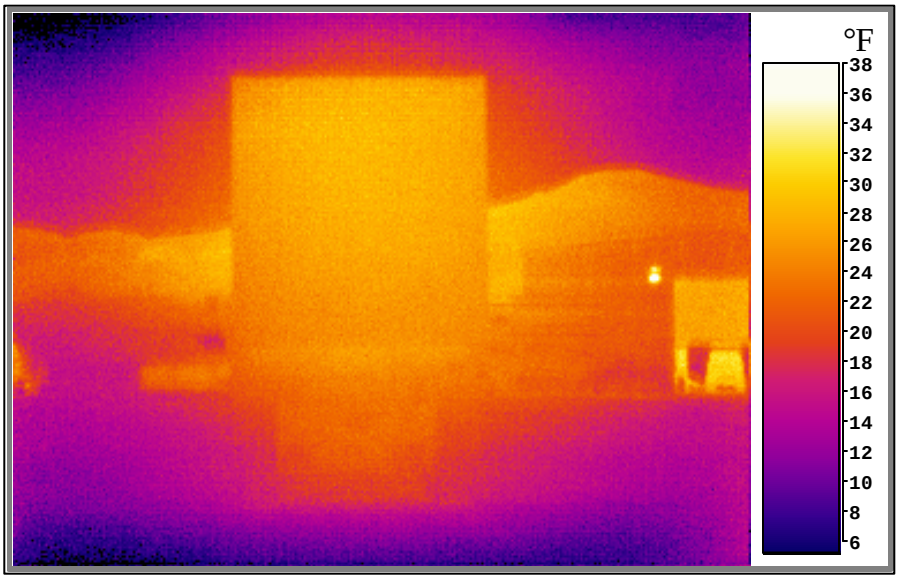
INFRARED IMAGE VEHICLE DRIVER SIDE



20.5°F Ambient Temperature

VISUAL IMAGE VEHICLE REAR

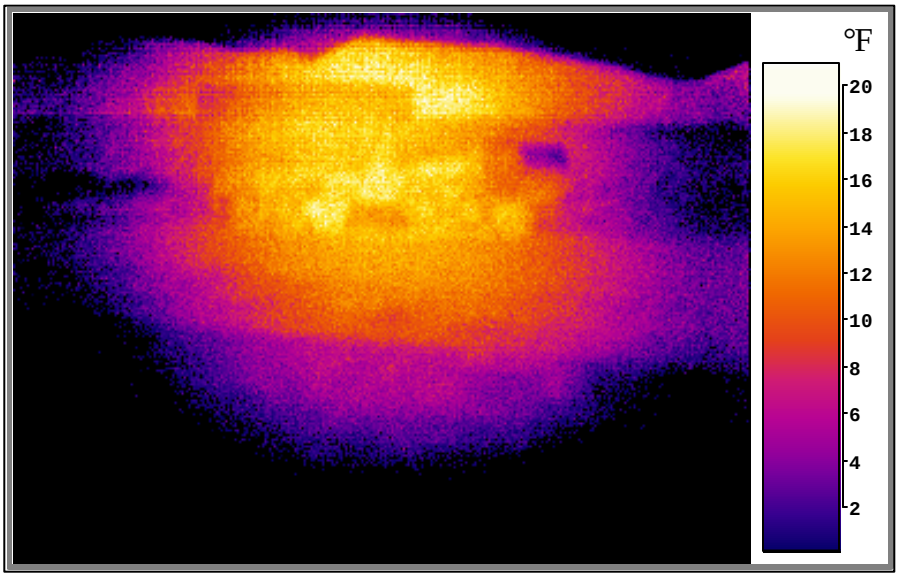
INFRARED IMAGE VEHICLE REAR



22.6°F Ambient Temperature

VISUAL IMAGE VEHICLE PASSENGER SIDE

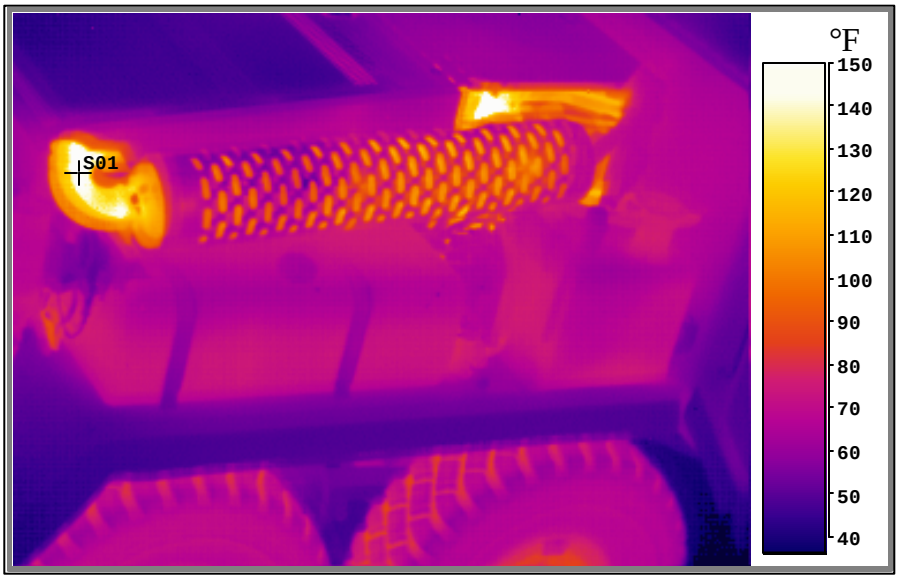
INFRARED IMAGE VEHICLE PASSENGER SIDE



22.6°F Ambient Temperature

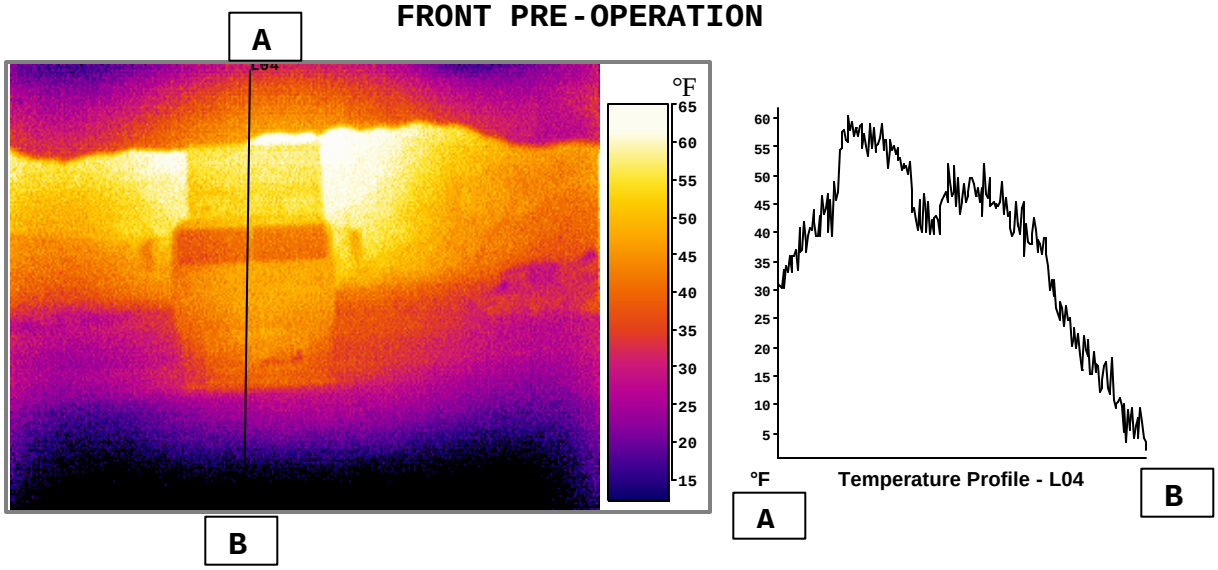
VISUAL IMAGE VEHICLE AERIAL VIEW

INFRARED IMAGE VEHICLE AERIAL VIEW

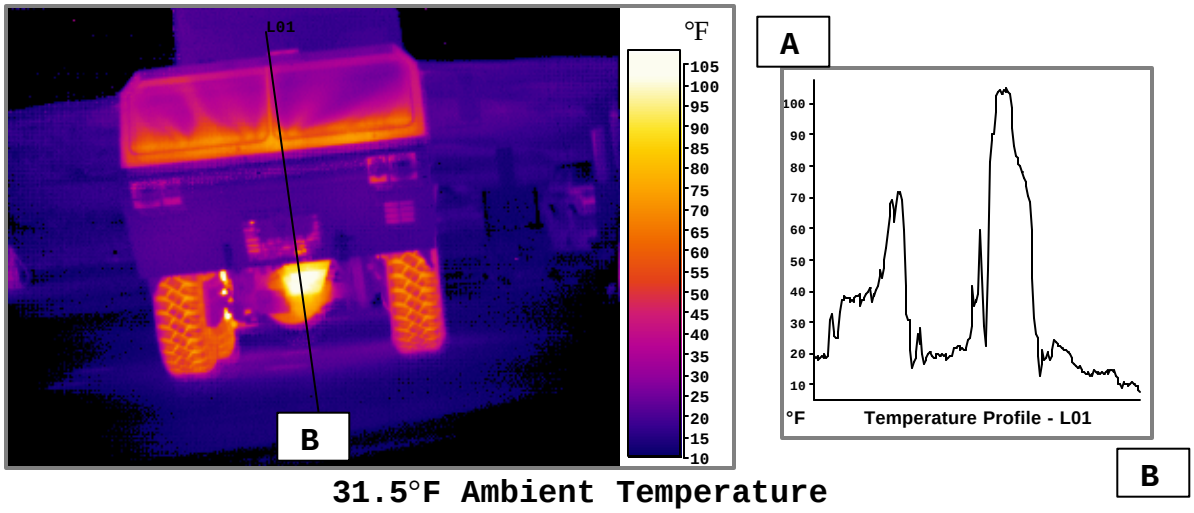


31.5°F Ambient Temperature (Post Operation)

FRONT PRE-OPERATION



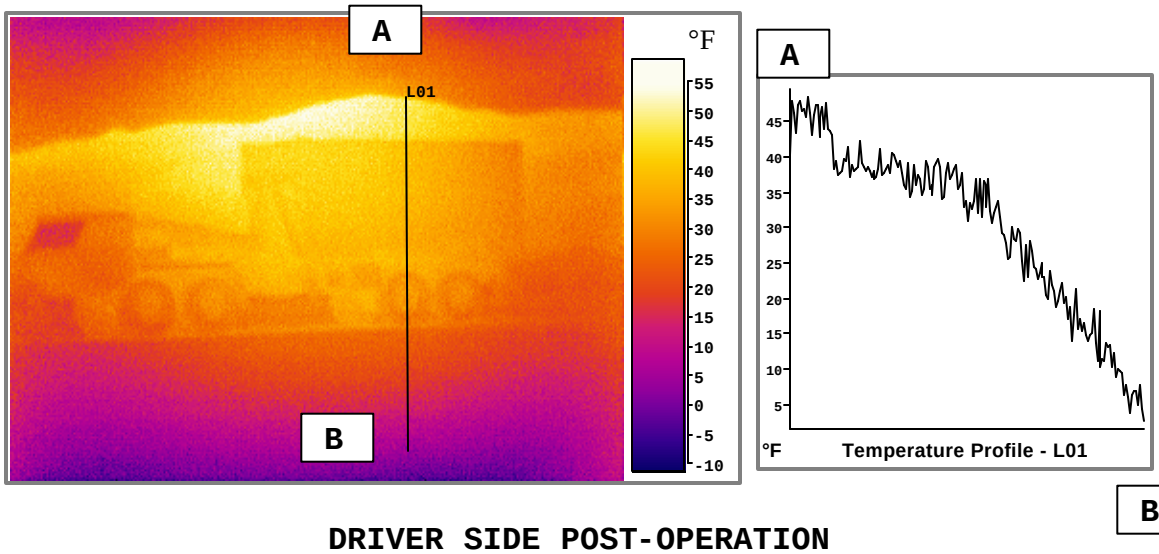
FRONT POST-OPERATION



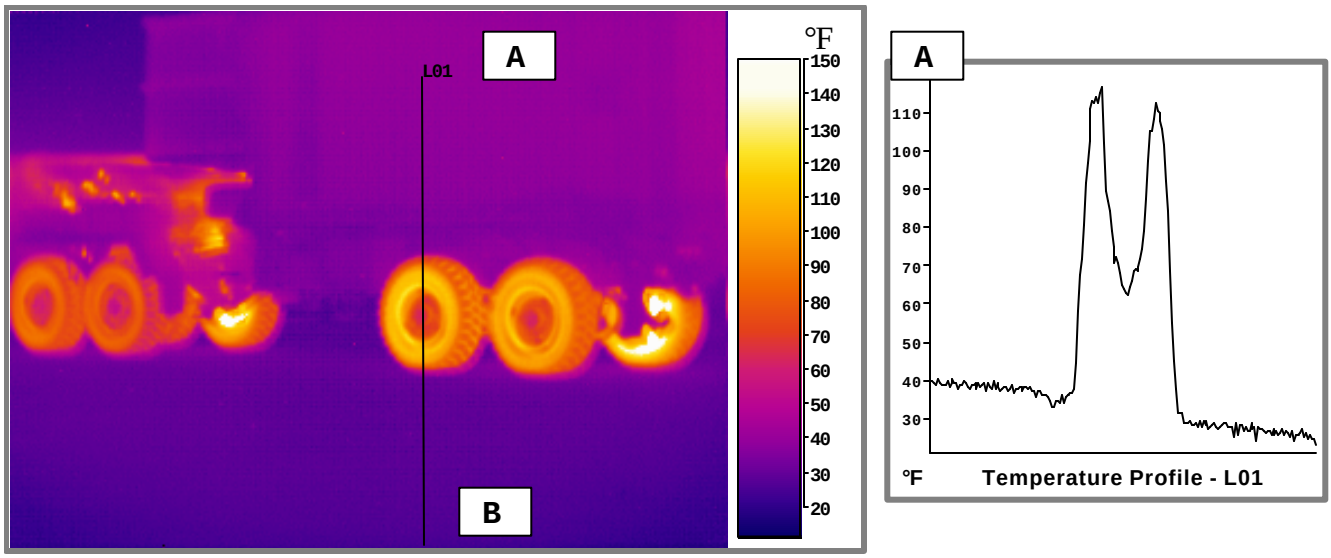
31.5°F Ambient Temperature

Note: Temperature profile corresponds to the straight line from top (A) to bottom (B), as shown in the photographs.

DRIVER SIDE PRE-OPERATION

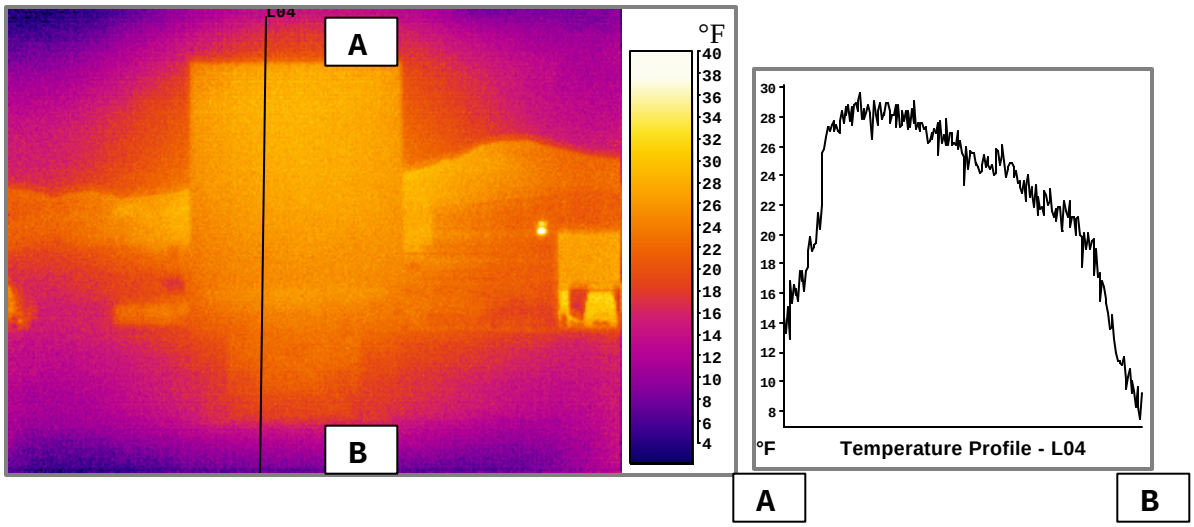


DRIVER SIDE POST-OPERATION

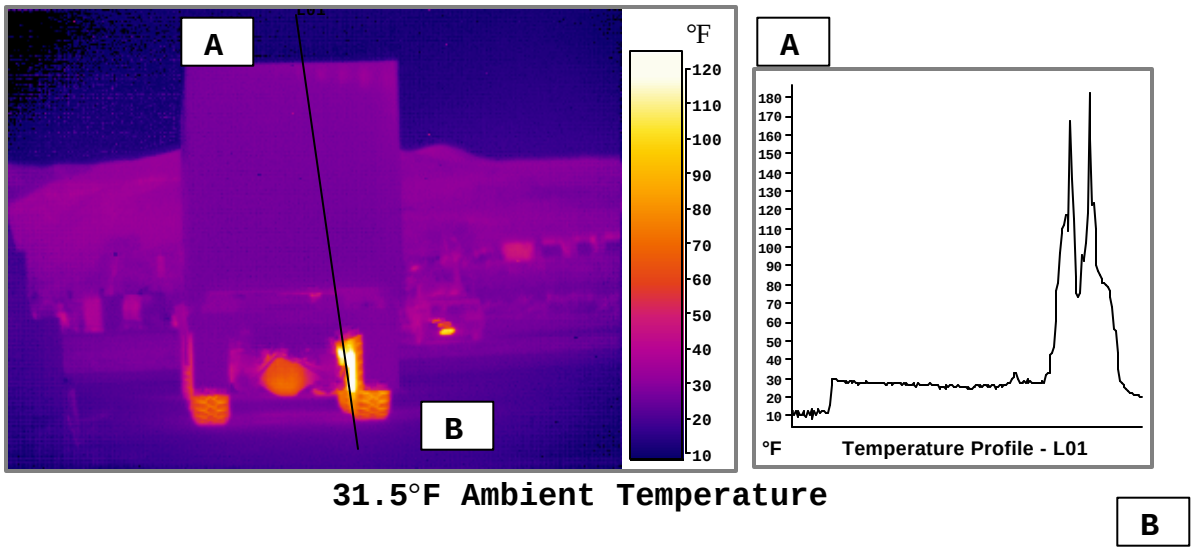


31.5°F Ambient Temperature

REAR PRE-OPERATION

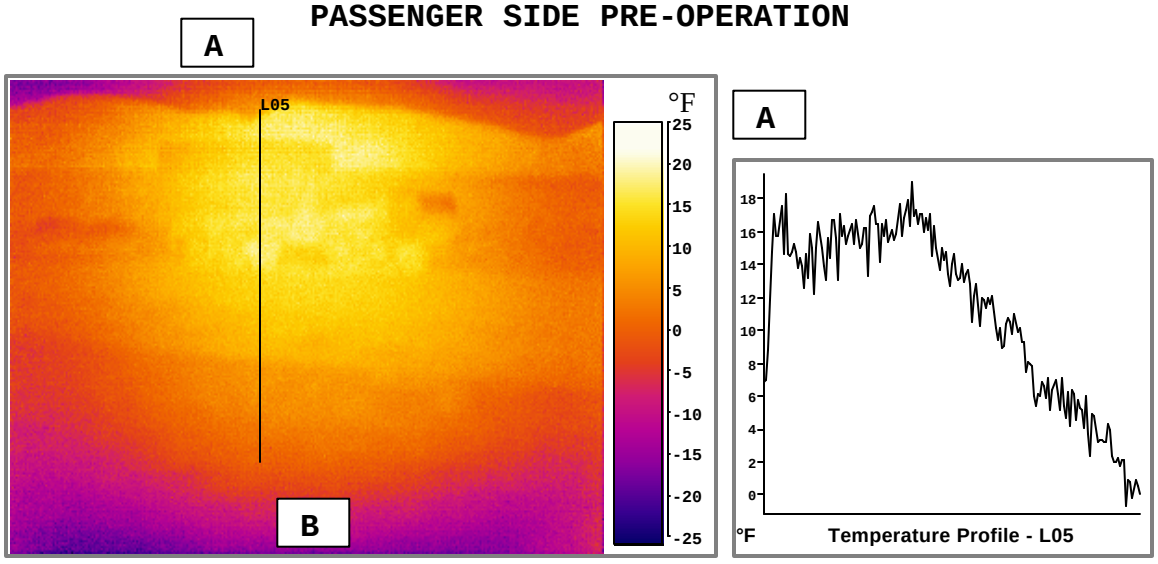


REAR POST-OPERATION

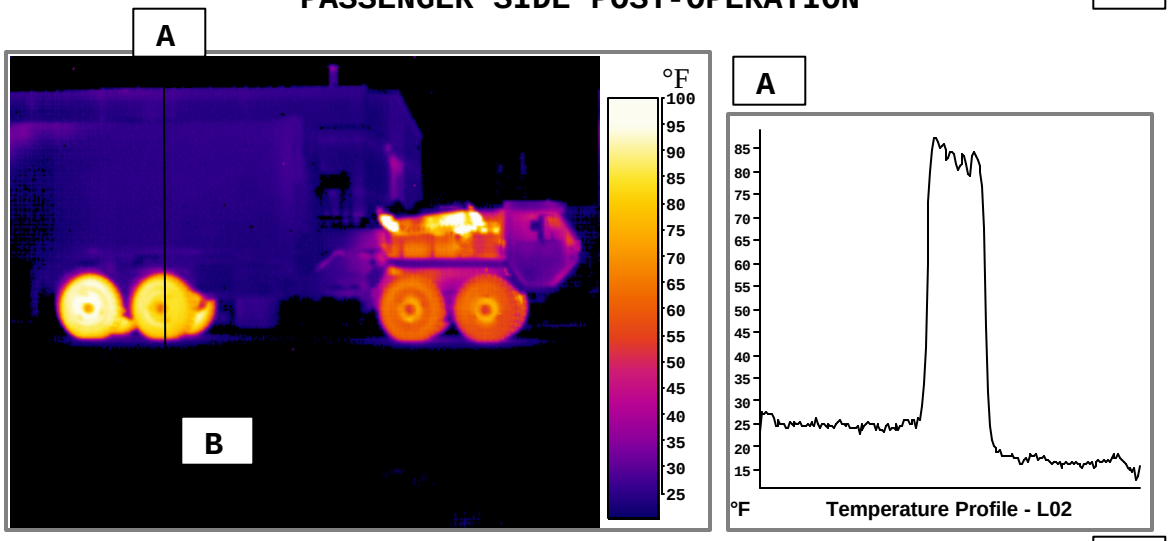


31.5°F Ambient Temperature

PASSENGER SIDE PRE-OPERATION

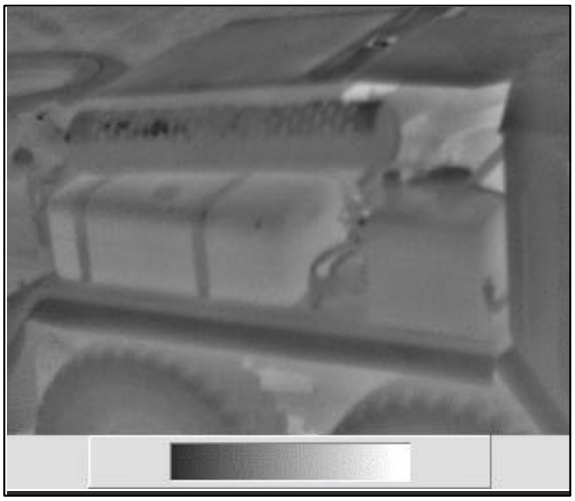


PASSENGER SIDE POST-OPERATION



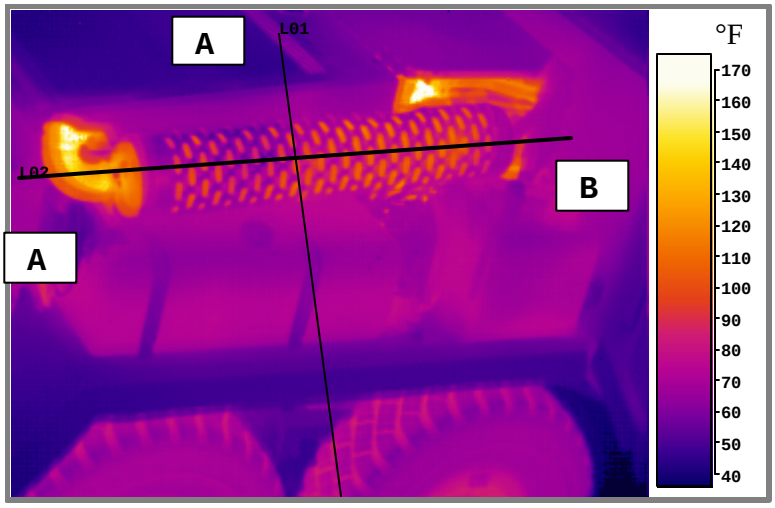
31.5°F Ambient Temperature

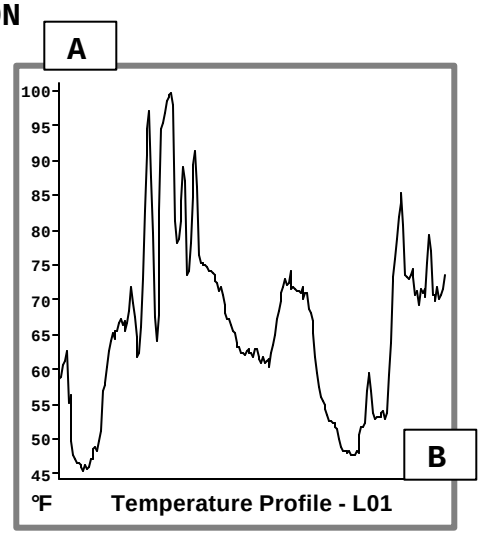
AERIAL PRE-OPERATION

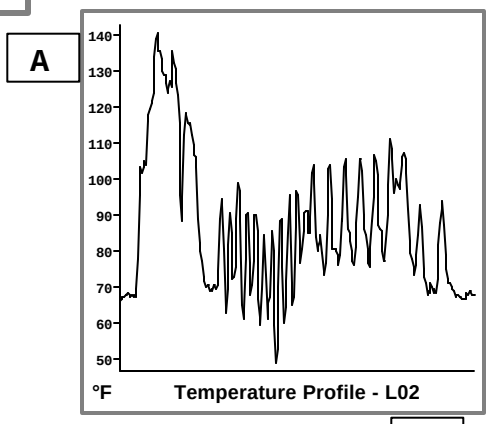


20.5°F Ambient Temperature

AERIAL POST-OPERATION







31.5°F Ambient Temperature

5.0 LVS SOUND TEST

A sound measurement test was conducted to quantify the exterior noise levels produced by the LVS vehicle during operation.

5.1 Procedure

The sound level measurement locations were determined using Figure 5, TOP 1-2-608. The layout of the sound measurement locations is provided in Figure 1. The vehicle was oriented with the front of the vehicle facing zero (0) degrees.

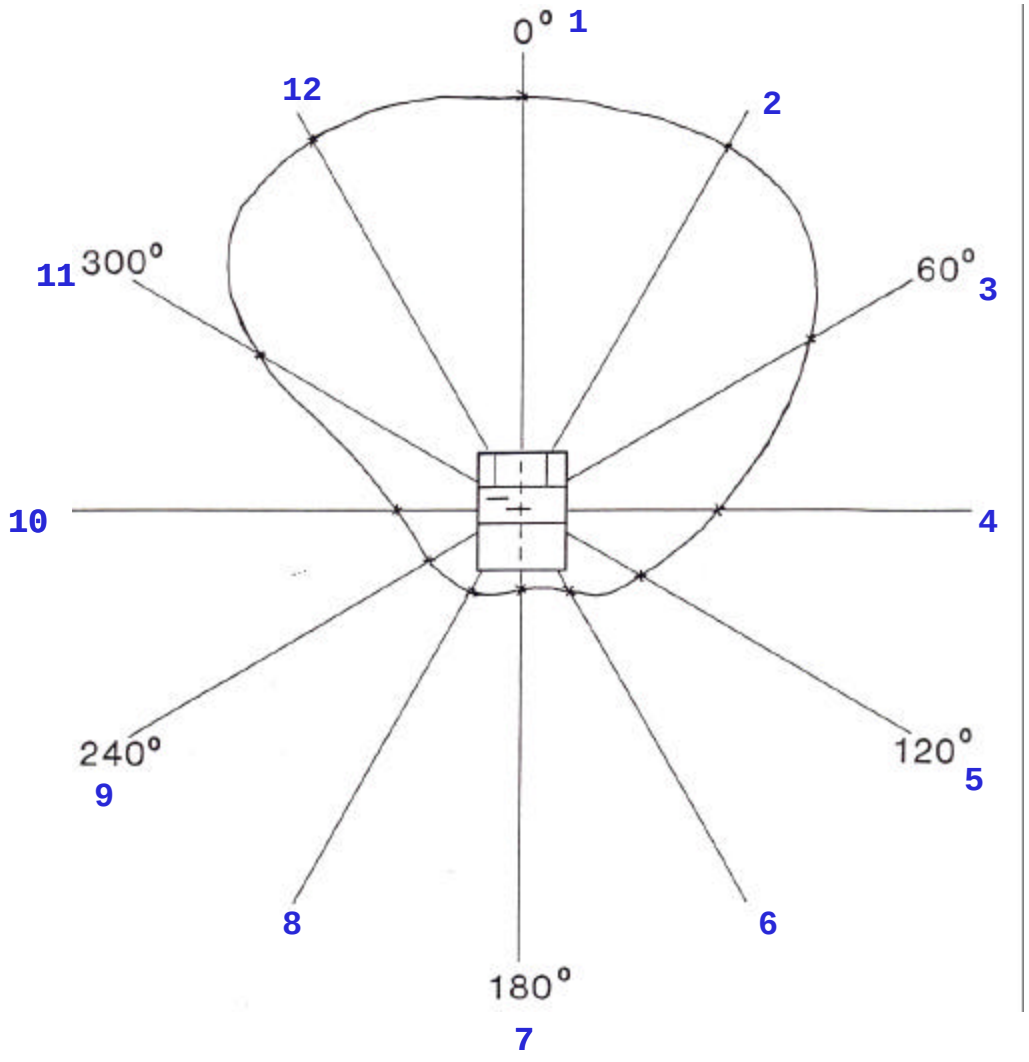


Figure 1
Sound Measurement Locations

Twelve (12) measurement positions were numbered from 1 through 12 to allow for easy identification of each location. Each position is identified as displayed in Figure 1 above, and all sound measurements were recorded at a distance of fifty (50) feet from the vehicle.

Measurements were taken at each location for a time duration of fifteen (15) seconds. Measurements were taken with the vehicle engine at high idle (1,250 rpm) and engine fan on high. In addition, ambient sound level measurements were taken before and after the test and a static (calibration) measurement was taken before the test.

5.2 Test Environment

The test was conducted on a flat, compacted gravel surface. The measurement site was situated approximately one hundred (100) feet from the nearest sound-reflecting obstacle. The distance from the test vehicle to each measurement point (See Figure 1) was approximately fifty (50) feet.

5.3 Test Data

a. Test item and nomenclature and identification data: USMC number 561452, Front Power Unit, MK48, NSN 2320-01-177-5167; Rear Body Unit, MK18A1, USMC number 563803, NSN 2320-01-392-0293
b. Test item condition: High idle, cooling fan on high, no payload
c. Test site: WesTrack, compacted gravel surface, level terrain
d. Type of test: stationary
e. Meteorological data:

TEMPERATURE	HUMIDITY	BAROMETRIC PRESSURE	SKY COVER	WIND DIRECTION	WIND VELOCITY
32.6°	56.5 RH	1029 Mb	Clear	South to North	0.5 mph

f. Nomenclature, model and serial numbers, and manufacturer of instrumentation:

NOMENCLATURE	MODEL	SERIAL #	MANUFACTURER
Sound meter	2230	1184353	Bruel & Kjaer
Megadac	5414	SO5364	Optim
Laptop	Satellite Pro 4600	9355	Toshiba

g. Name of test conductor and equipment operator: A NATC engineer, instrumentation technician and test vehicle operator conducted the test.
h. Microphone locations: See Figure 1.
i. Sound levels in dB(A), dB(C), and in each octave band: See paragraph 5.4, Test Results.
j. Noise contour data (distances and directions from the equipment at which the specified noise limit is measured): 50 feet from the vehicle in the direction annotated in degrees in Figure 1.

5.4 Test Results

The sound levels were recorded in dB(A) and dB(C) in each octave band. The following tables show those results. The graphs for the data are contained in Appendix A.

Table 1
Sound Levels in dB(A)

RUN	TOTAL RMS dB(A)	PEAK RMS dB(A)	PEAK FREQ (Hz)	DESCRIPTION
1	93.8	96.8	1000	Static-Calibration
2	37.3	32.4	125	Ambient
3	68.8	66.8	1000	Location 1, Figure 1
4	69.7	69.4	1000	Location 2, Figure 1
5	71.0	69.8	1000	Location 3, Figure 1
6	72.3	72.1	1000	Location 4, Figure 1
7	69.8	68.6	1000	Location 5, Figure 1
8	65.6	64.5	1000	Location 6, Figure 1
9	62.8	60.0	63	Location 7, Figure 1
10	68.7	67.1	1000	Location 12, Figure 1
11	69.4	68.1	1000	Location 11, Figure 1
12	70.6	70.6	1000	Location 10, Figure 1
13	68.1	67.0	1000	Location 9, Figure 1
14	66.4	63.5	1000	Location 8, Figure 1
15	37.6	34.3	250	Ambient

Table 2
Sound Levels in dB(C)

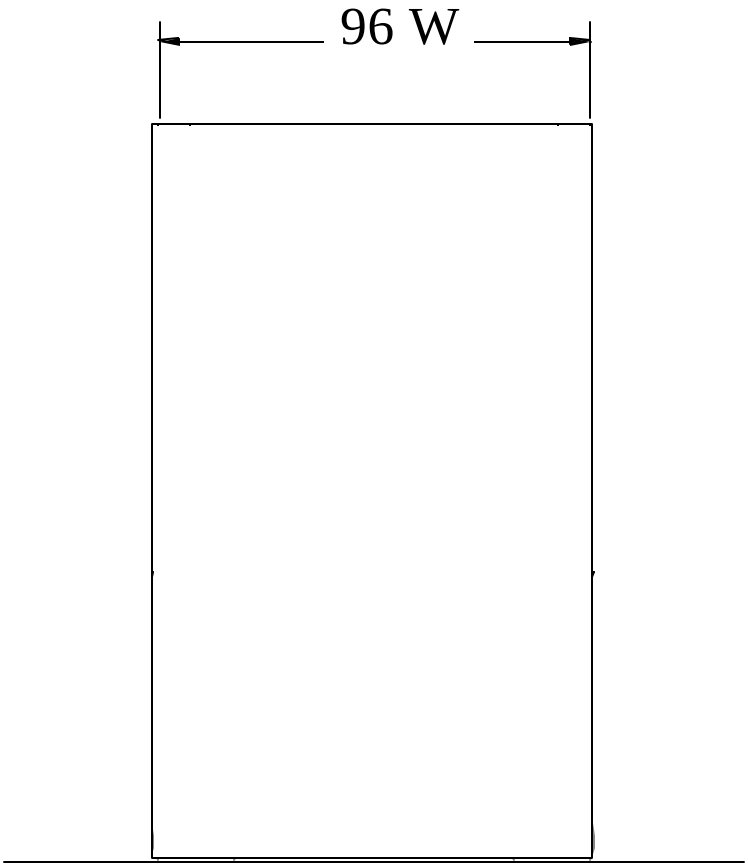
RUN	TOTAL RMS dB(C)	PEAK RMS dB(C)	PEAK FREQ (Hz)	DESCRIPTION
1	93.7	96.7	1000	Static-Calibration
2	53.1	53.4	63	Ambient
3	82.8	84.1	63	Location 1, Figure 1
4	82.1	84.0	63	Location 2, Figure 1
5	84.1	86.5	63	Location 3, Figure 1
6	85.3	87.8	63	Location 4, Figure 1
7	83.4	85.7	63	Location 5, Figure 1
8	81.5	84.0	63	Location 6, Figure 1
9	81.4	83.7	63	Location 7, Figure 1
10	83.9	86.0	63	Location 12, Figure 1
11	83.8	86.2	63	Location 11, Figure 1
12	83.5	85.6	63	Location 10, Figure 1
13	81.7	84.0	63	Location 9, Figure 1
14	83.7	86.2	63	Location 8, Figure 1
15	51.1	50.3	63	Ambient

6.0 VISUAL PROFILE

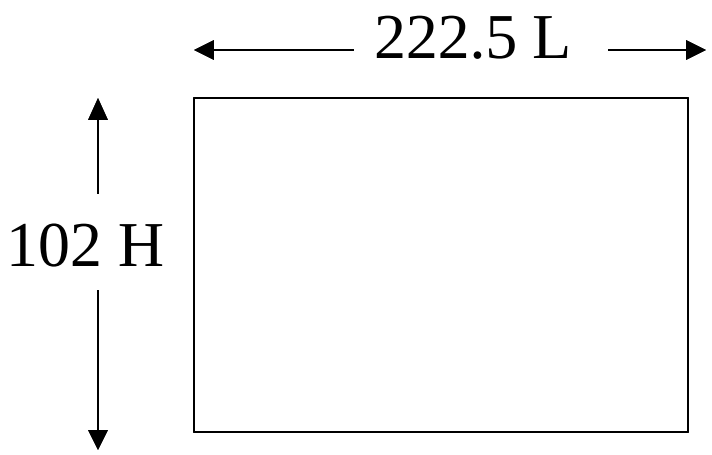
Measurements were taken and AutoCad drawings produced to determine and demonstrate the visual profile of the MK48/18A1 vehicle.

6.1 Profile Results

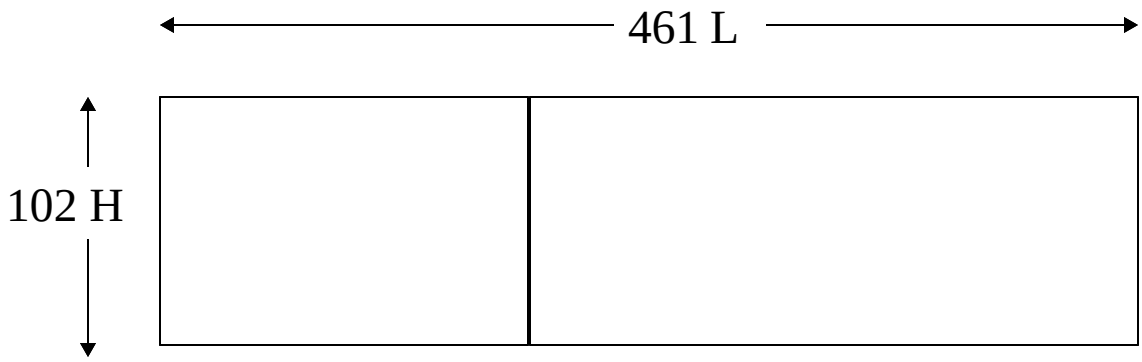
The following drawings show the representative simplified visual profiles for the MK48/18A1.



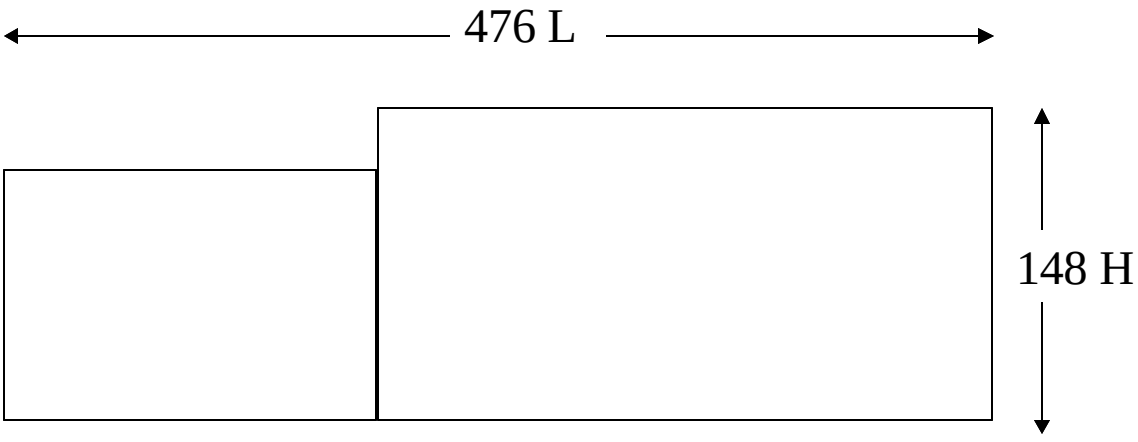
MK48 FRONT AND REAR PROFILES (INCHES)



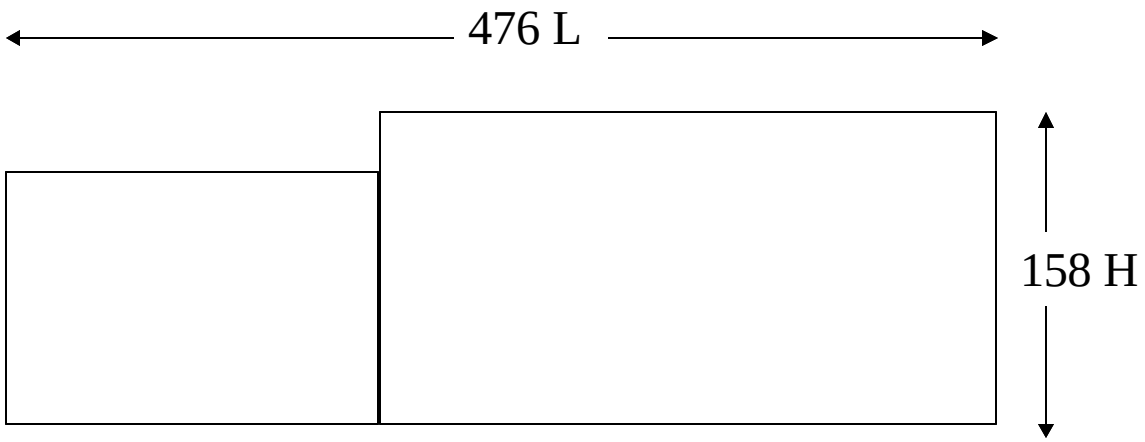
MAXIMUM MK18A1 SIDE PROFILE (HEIGHT X LENGTH IN INCHES)



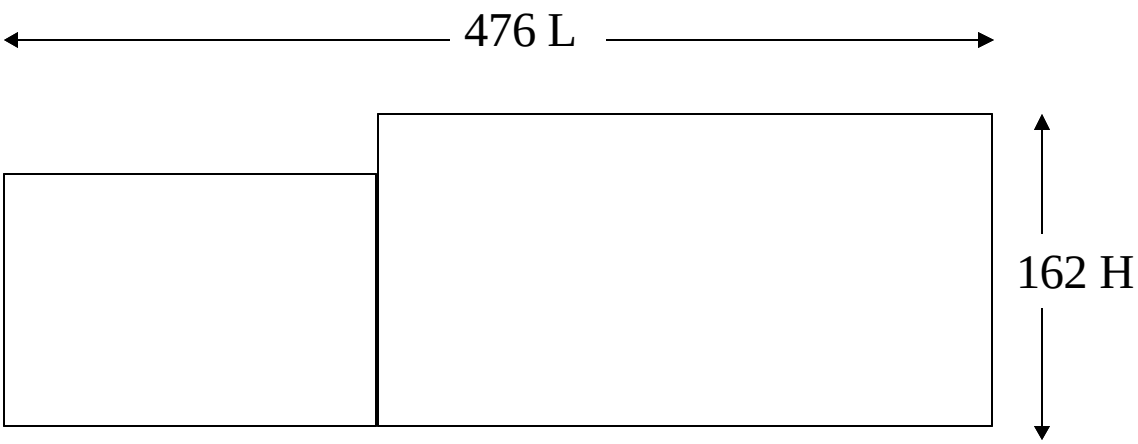
MAXIMUM MK48/18A1 SIDE PROFILE
(HEIGHT X LENGTH WHILE EMPTY IN INCHES)



MAXIMUMMK48/18A1 SIDE PROFILE
(HEIGHT X LENGTH UNLADEN IN CONTAINER MODE IN INCHES)



MAXIMUM MK48/18A1 SIDE PROFILE (HEIGHT X LENGTH LADEN WITH BRIDGE ERECTION BOAT AND CRADLE IN INCHES)



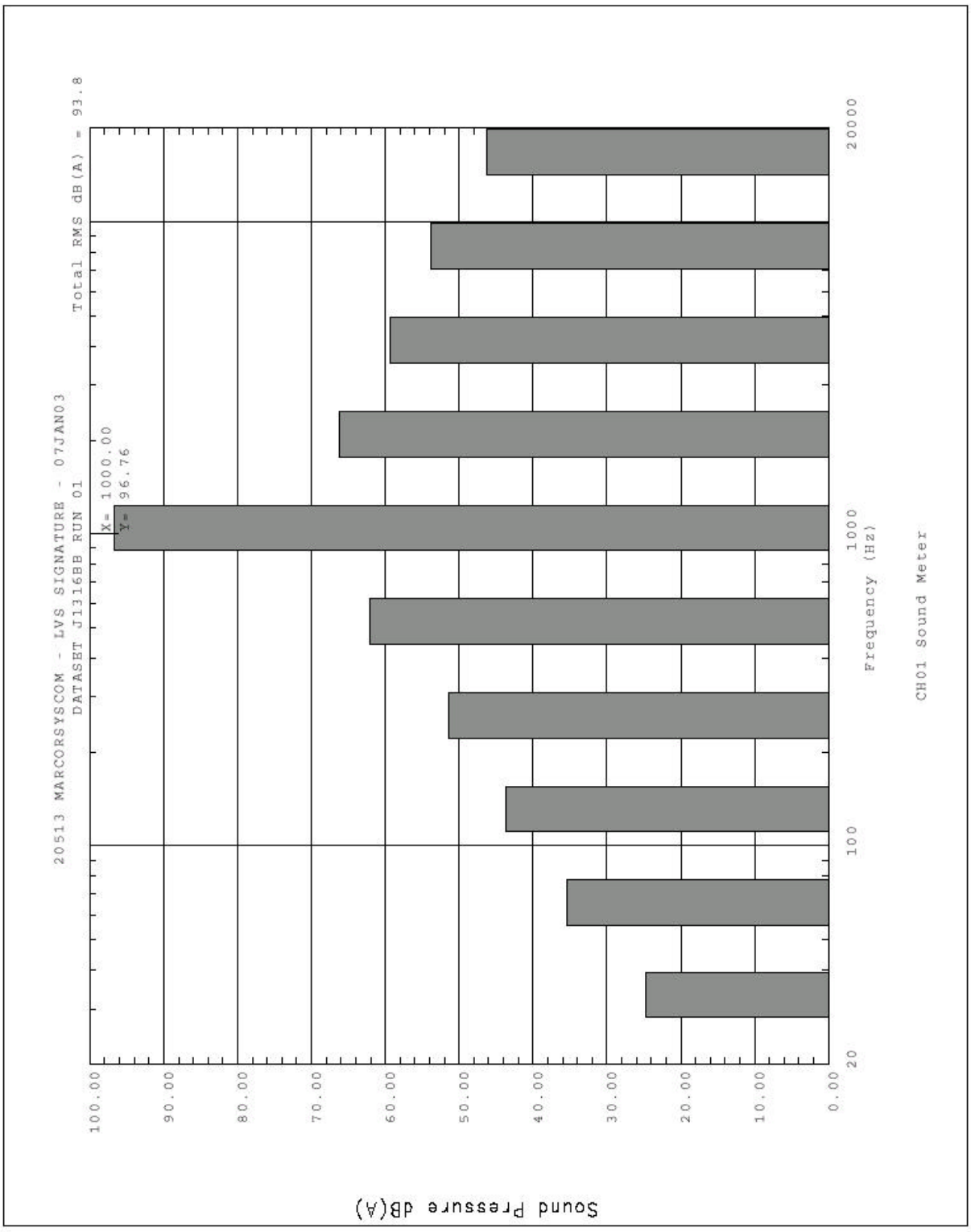
MAXIMUM MK48/18A1 SIDE PROFILE (HEIGHT X LENGTH LADEN WITH ISO CONTAINER OR RIBBON BRIDGE SECTION IN INCHES)

The measurements shown above are in inches.

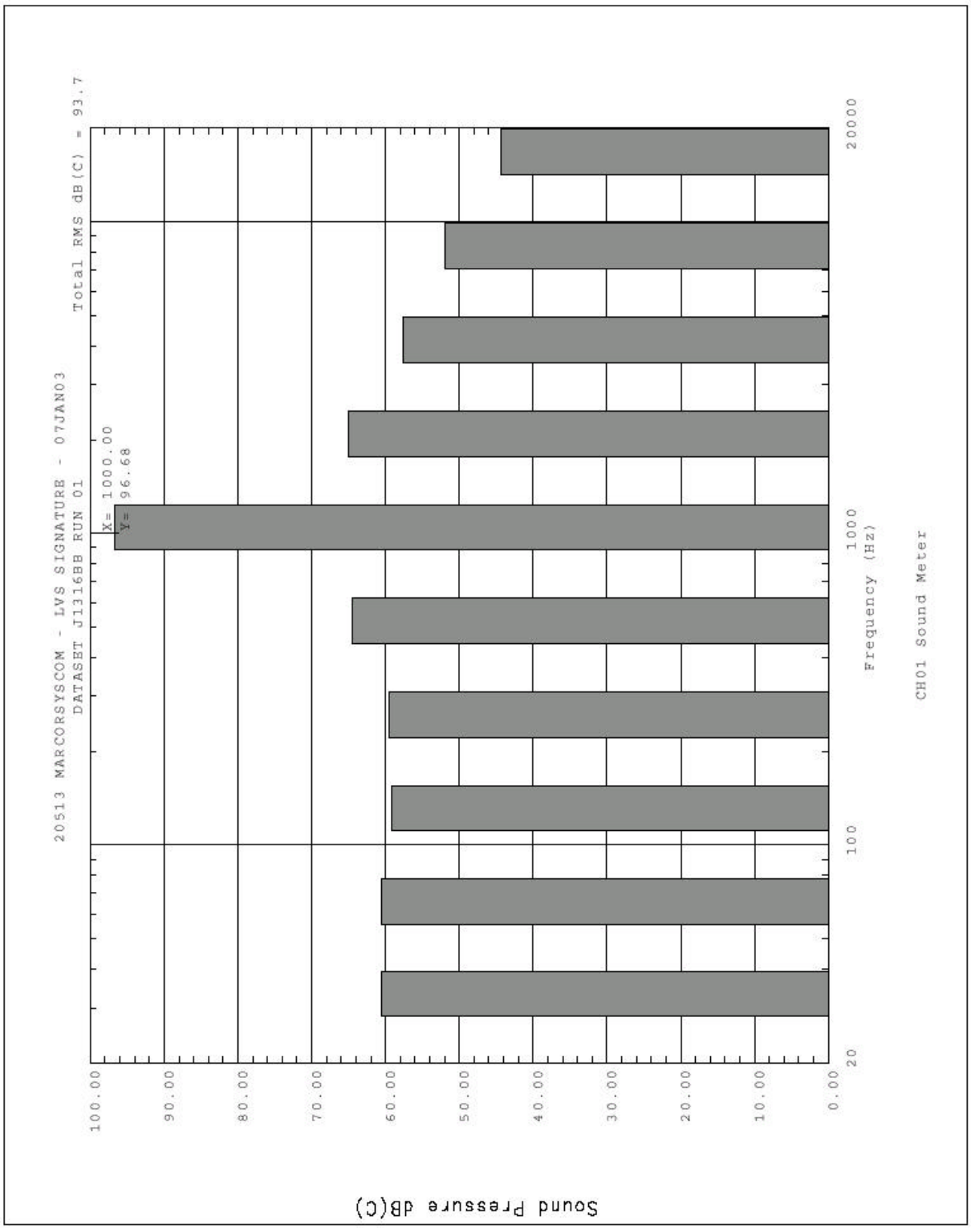
6.2 Conclusion

The results of these measurements are to be used by the United States Marine Corps as a baseline reference for the LVS. The results and data collected will be used for comparison purposes for future vehicle builds. The LVSR Draft ORD and Section 3.4.8 of the Performance Specification dated 10 June 2002 states "Under a tactical configuration, the infrared, audio, visual, and thermal signatures of each variant shall be no greater than the current LVS".

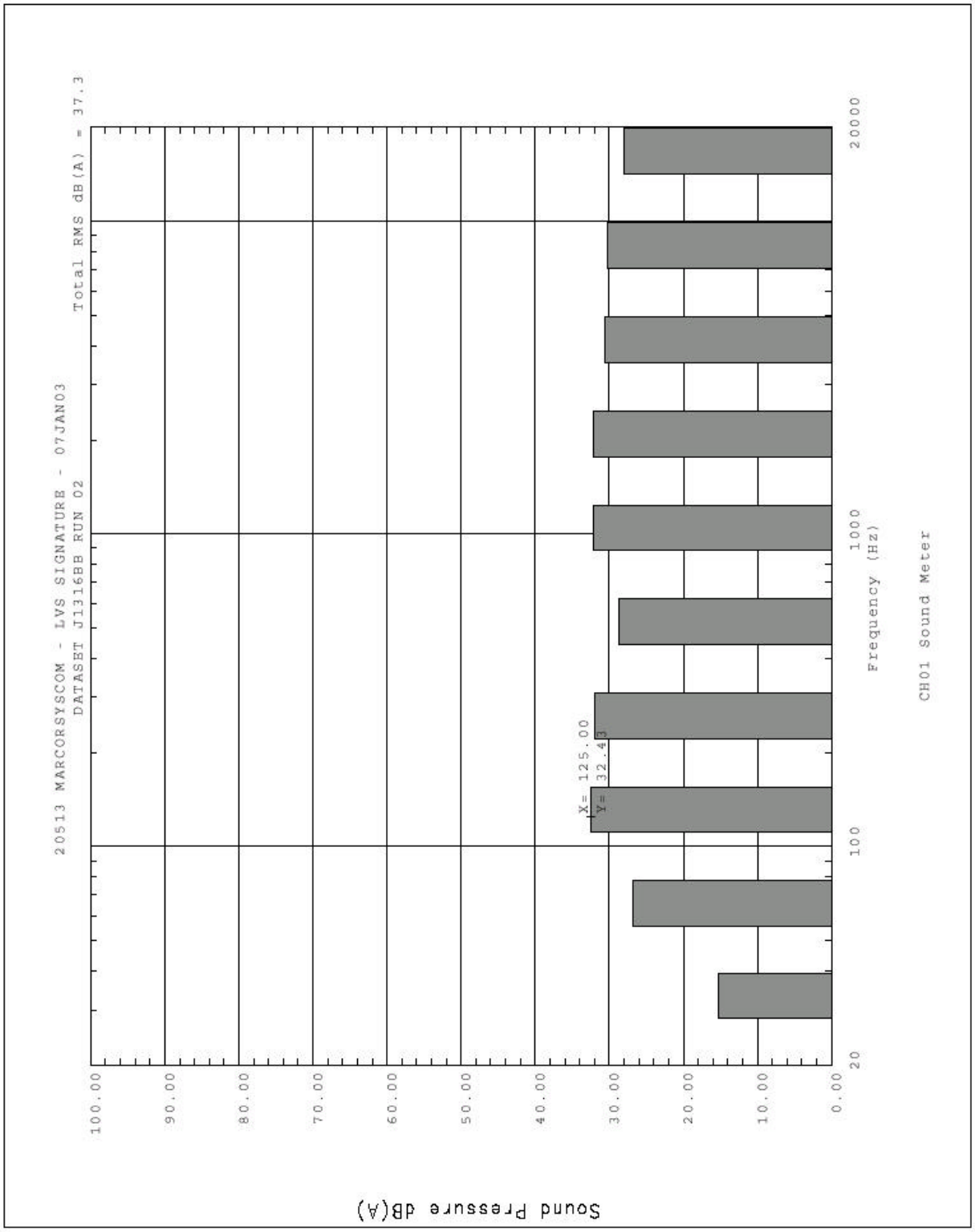
APPENDIX A
SOUND LEVEL MEASUREMENTS



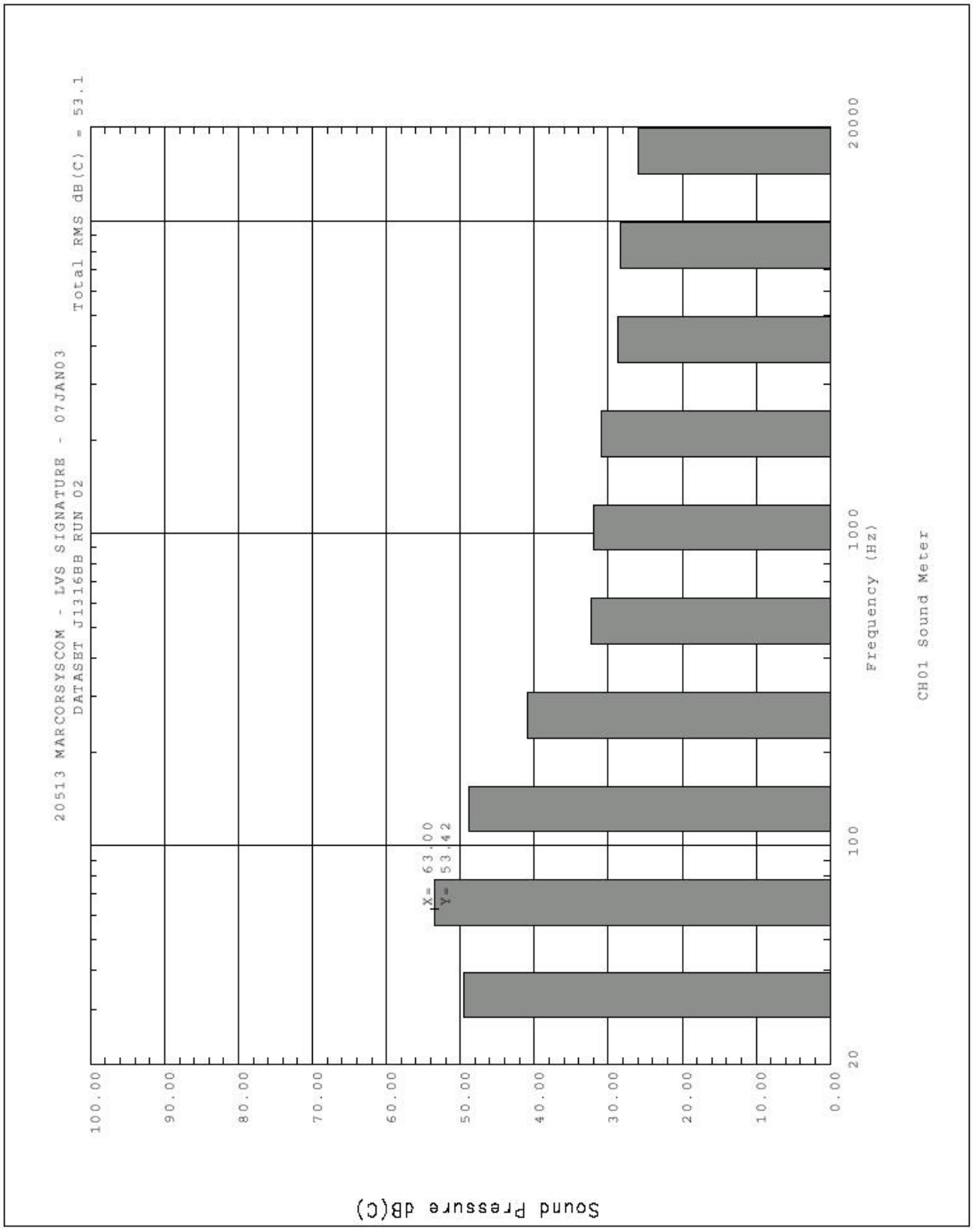
RUN 1
MEASUREMENT IN dB(A)



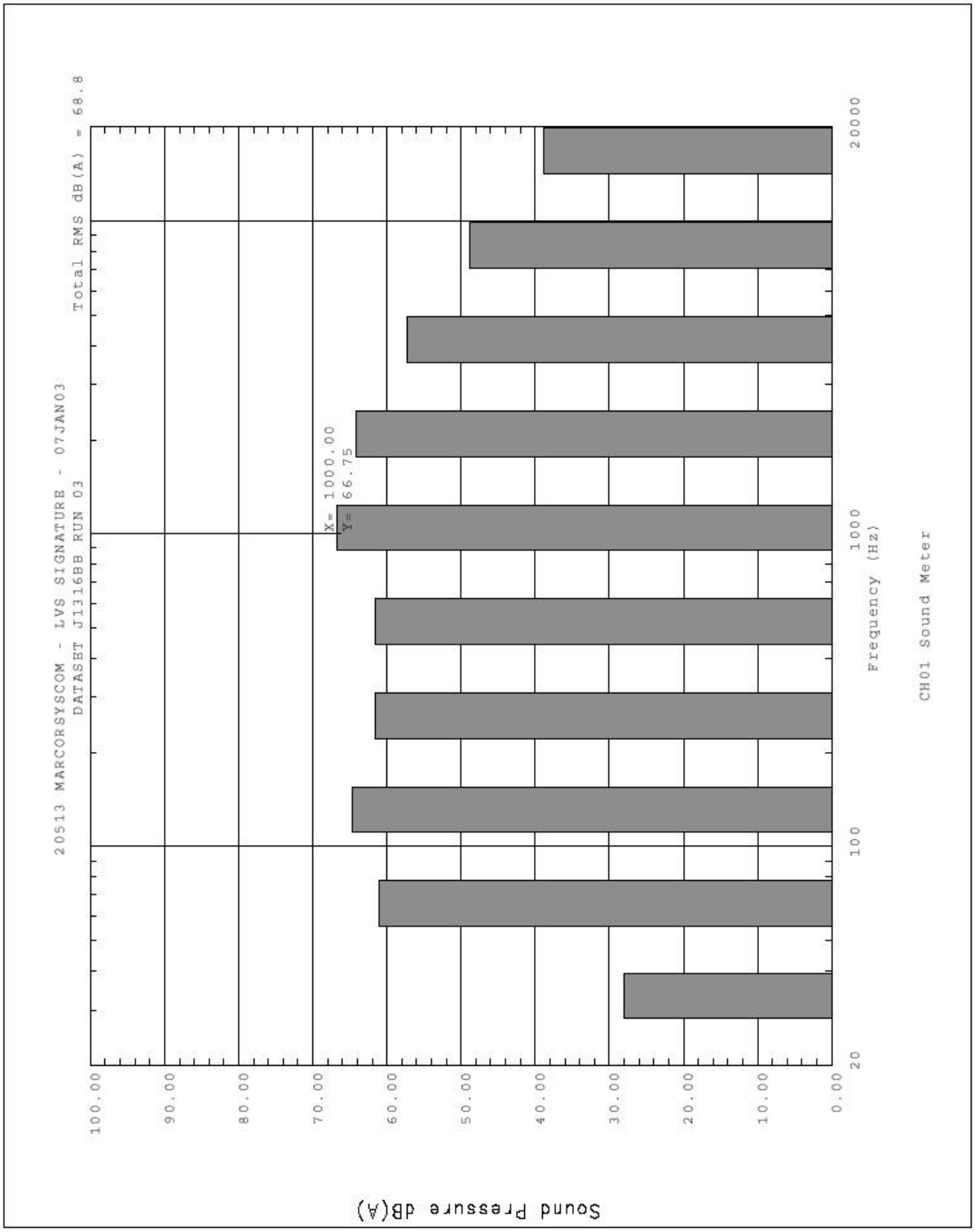
RUN 1
MEASUREMENT IN dB(C)



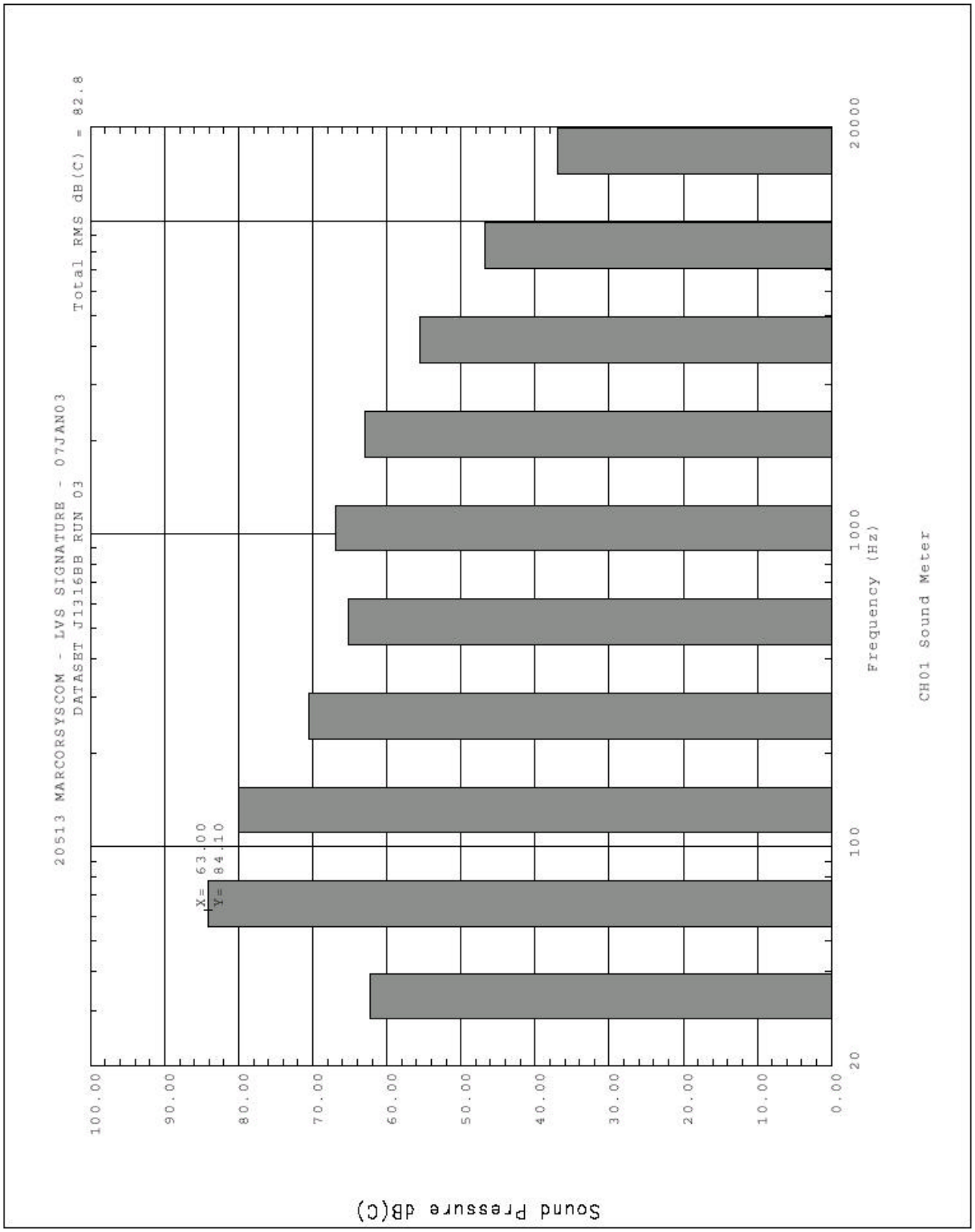
RUN 2
MEASURMENT IN dB(A)



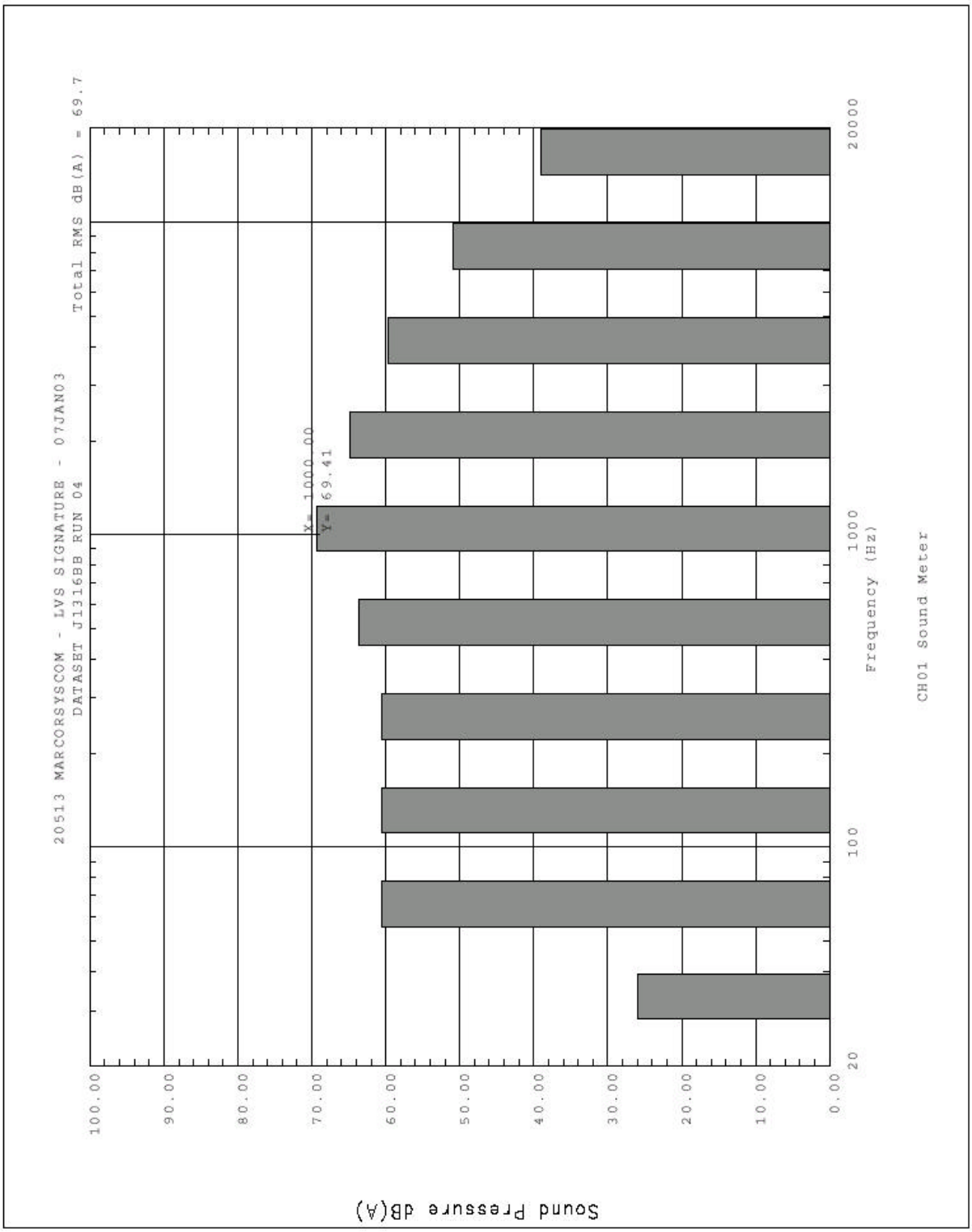
RUN 2
MEASURMENT IN dB(C)



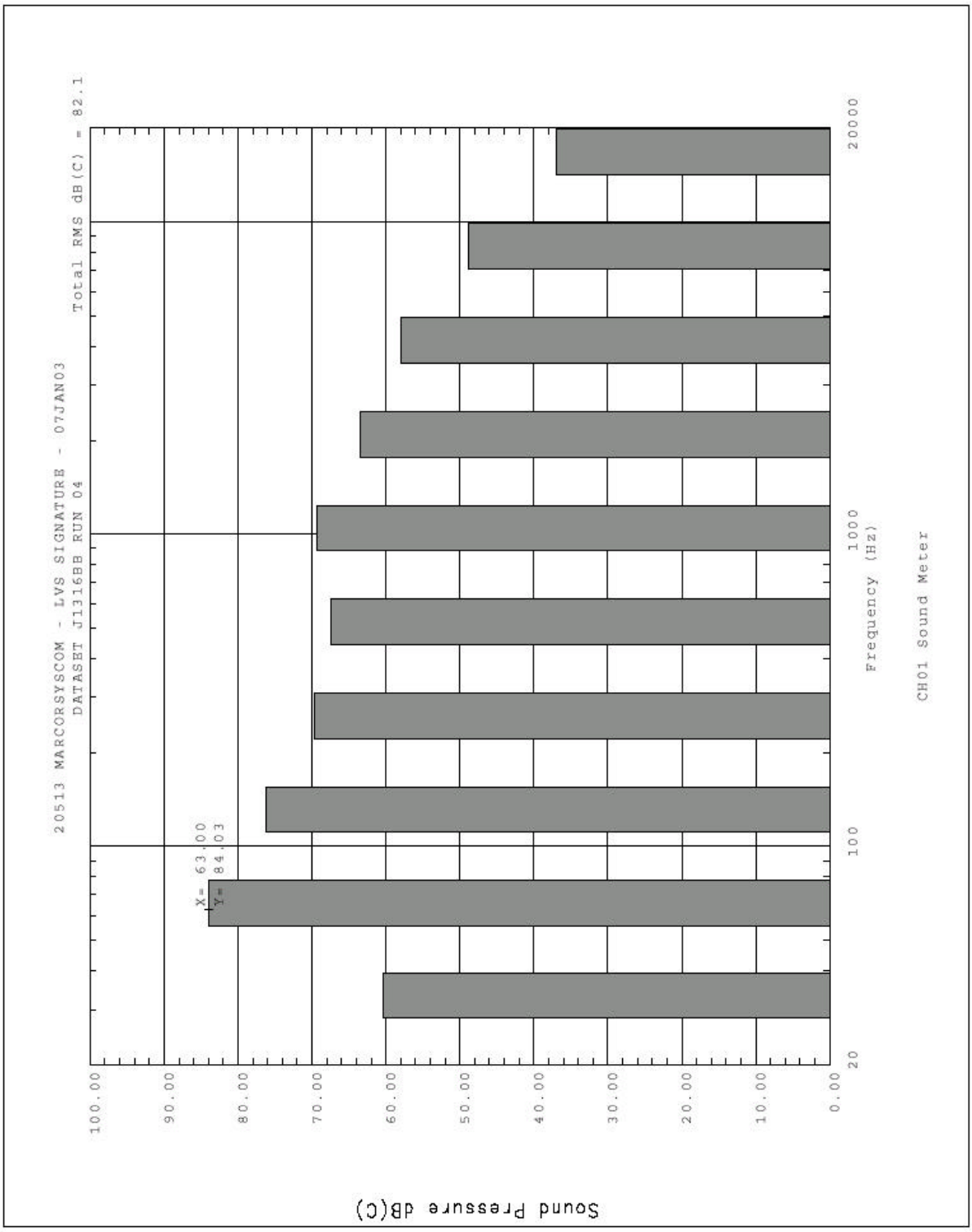
RUN 3
MEASURMENT IN dB(A)



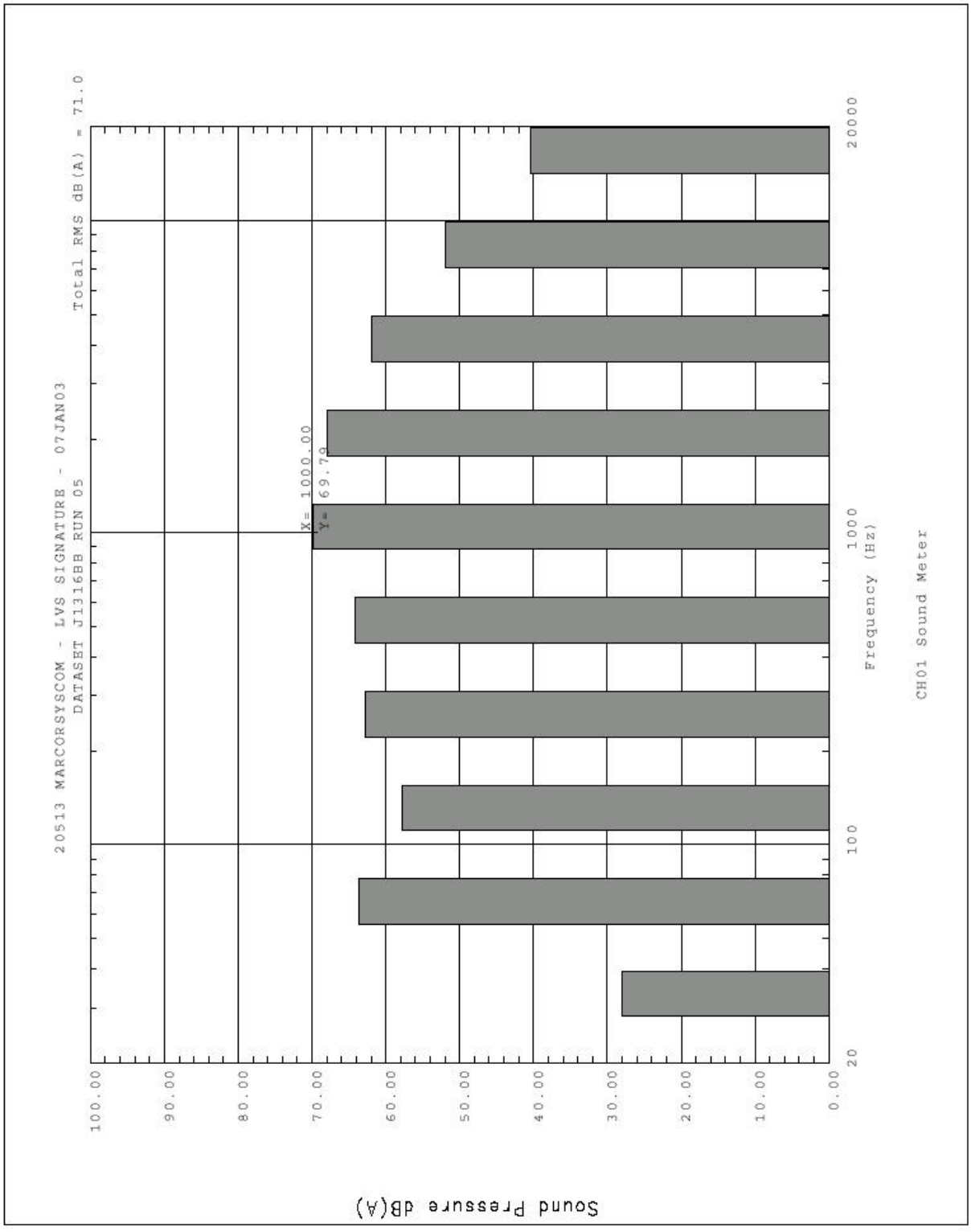
RUN 3
MEASURMENT IN dB(C)



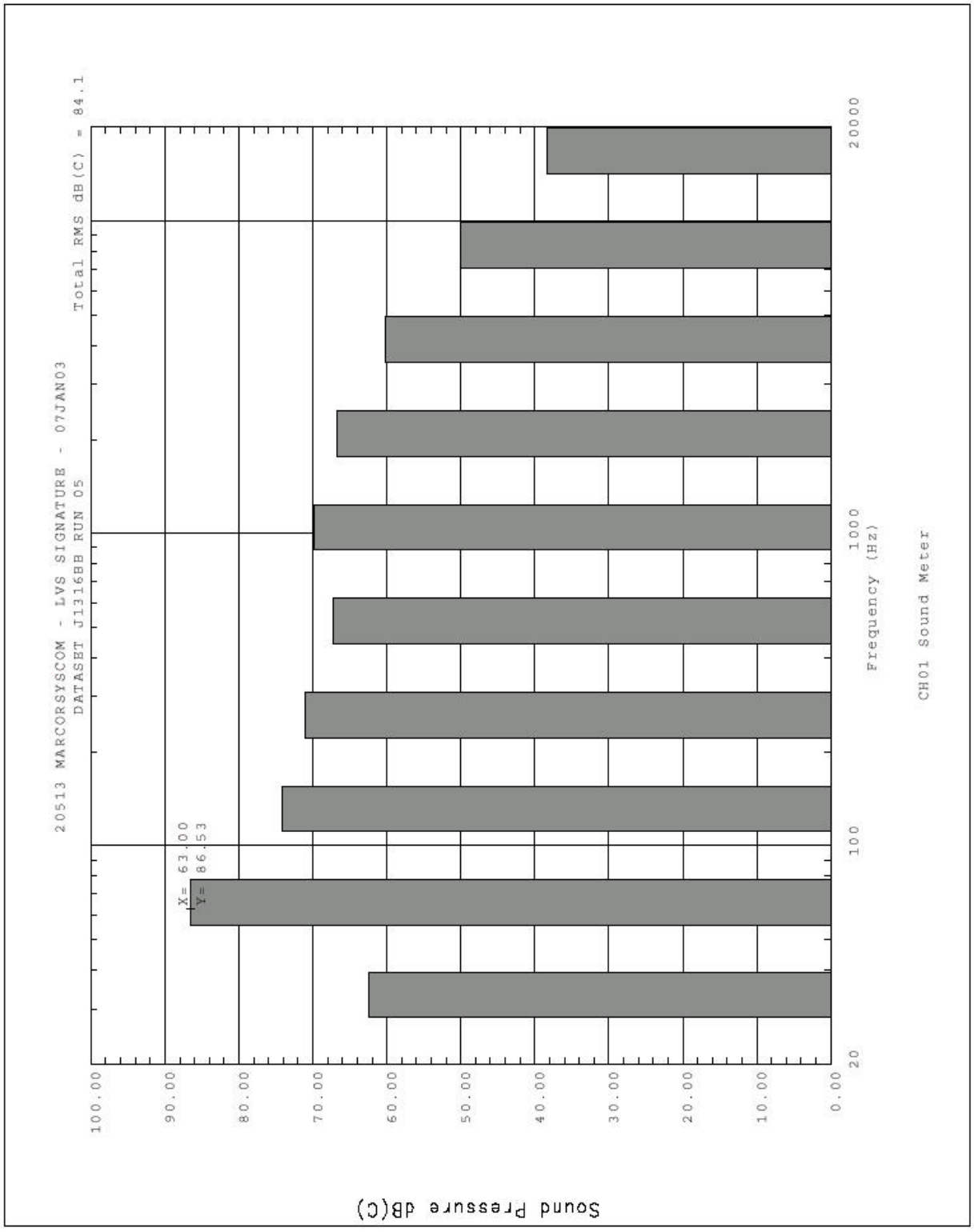
RUN 4
MEASUREMENT IN dB(A)



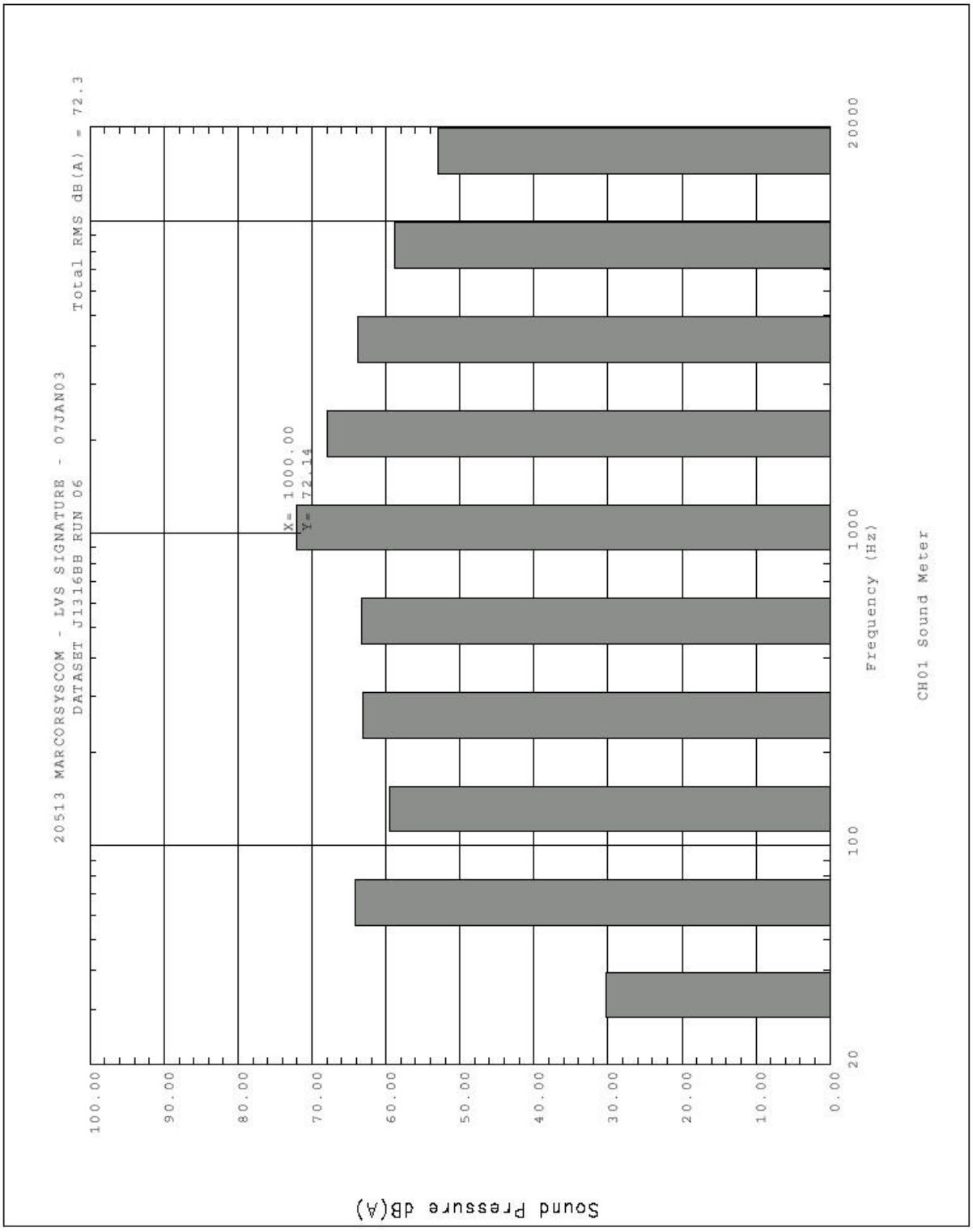
RUN 4
MEASUREMENT IN dB(C)



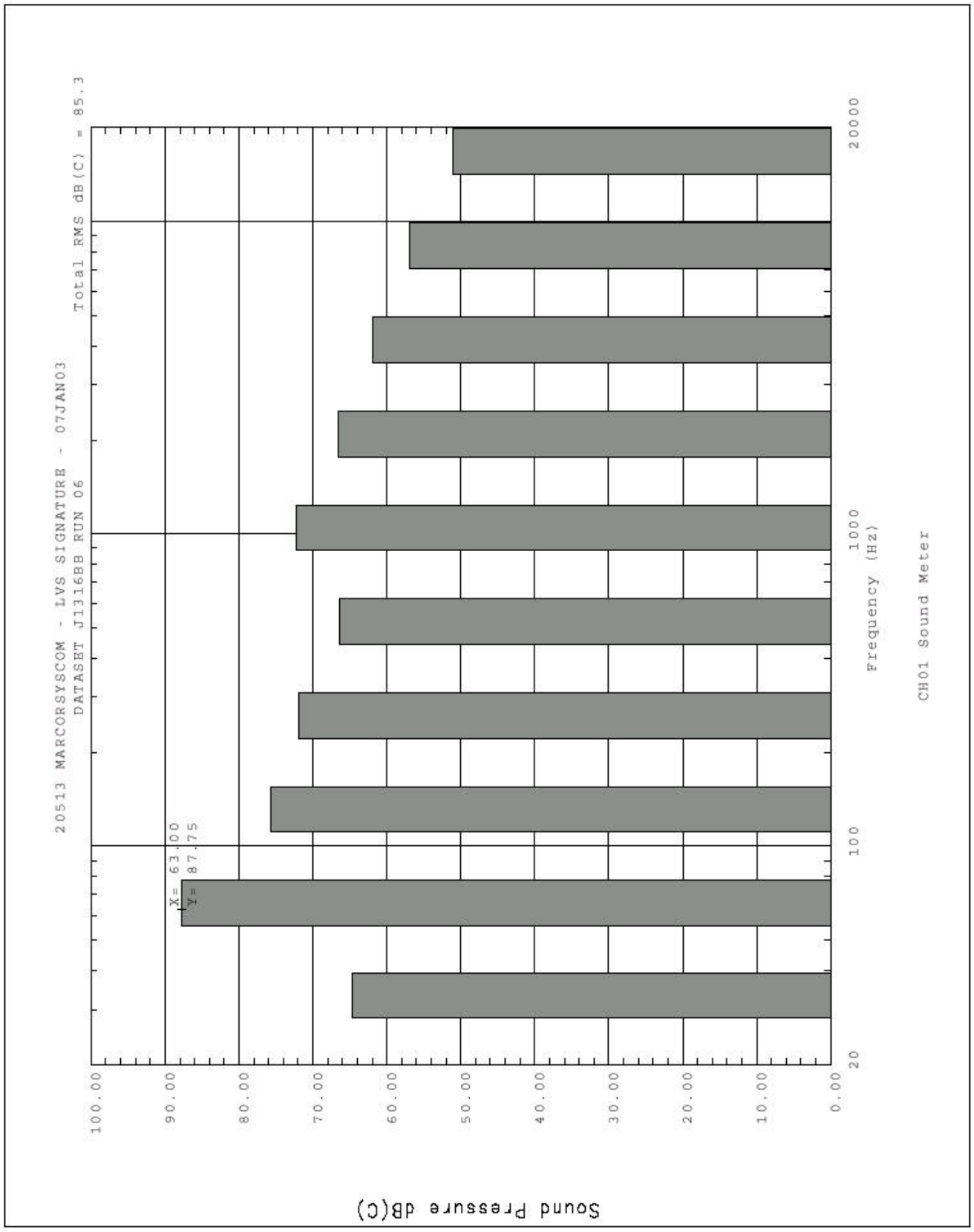
RUN 5
MEASUREMENT IN dB(A)



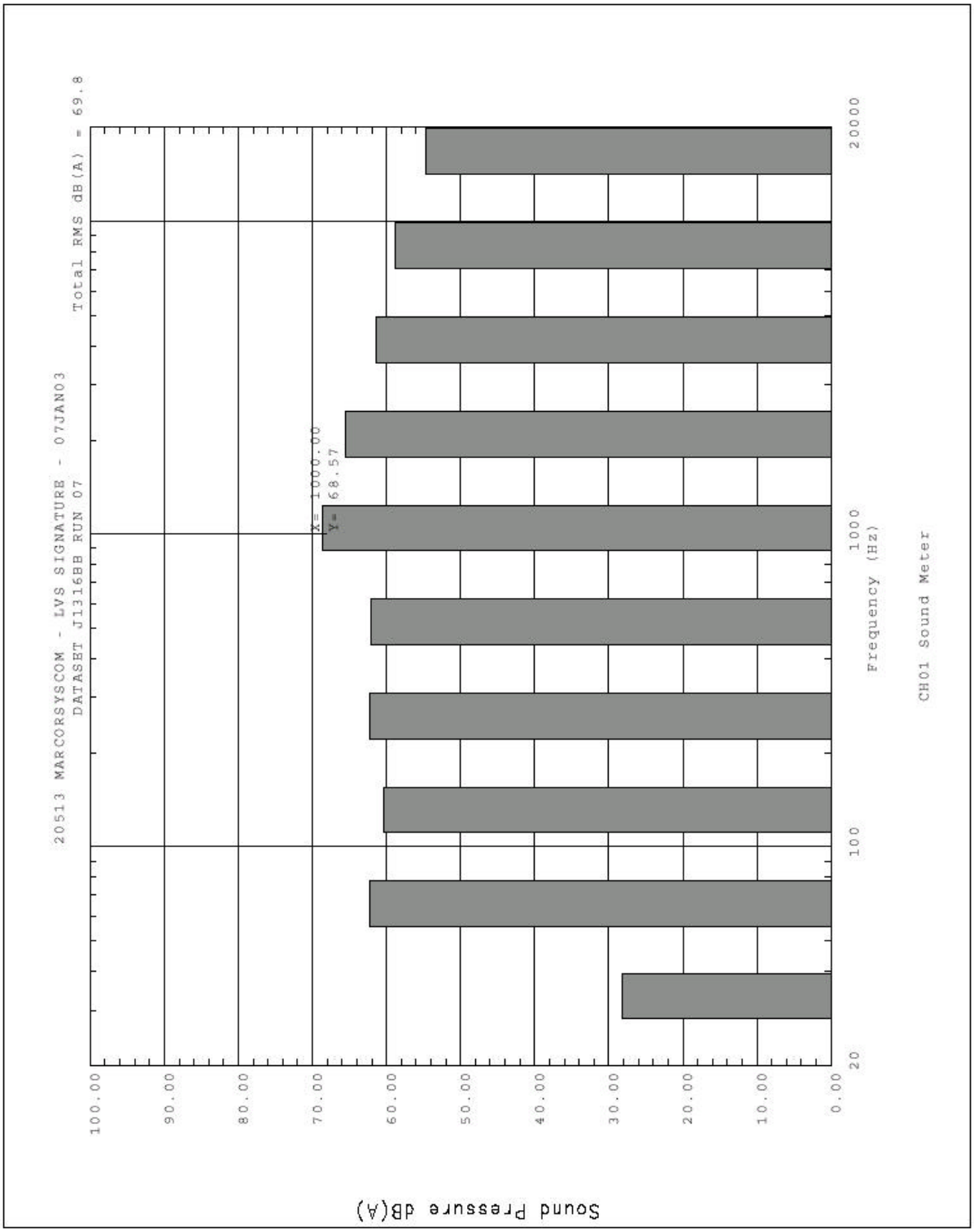
RUN 5
MEASUREMENT IN dB(C)



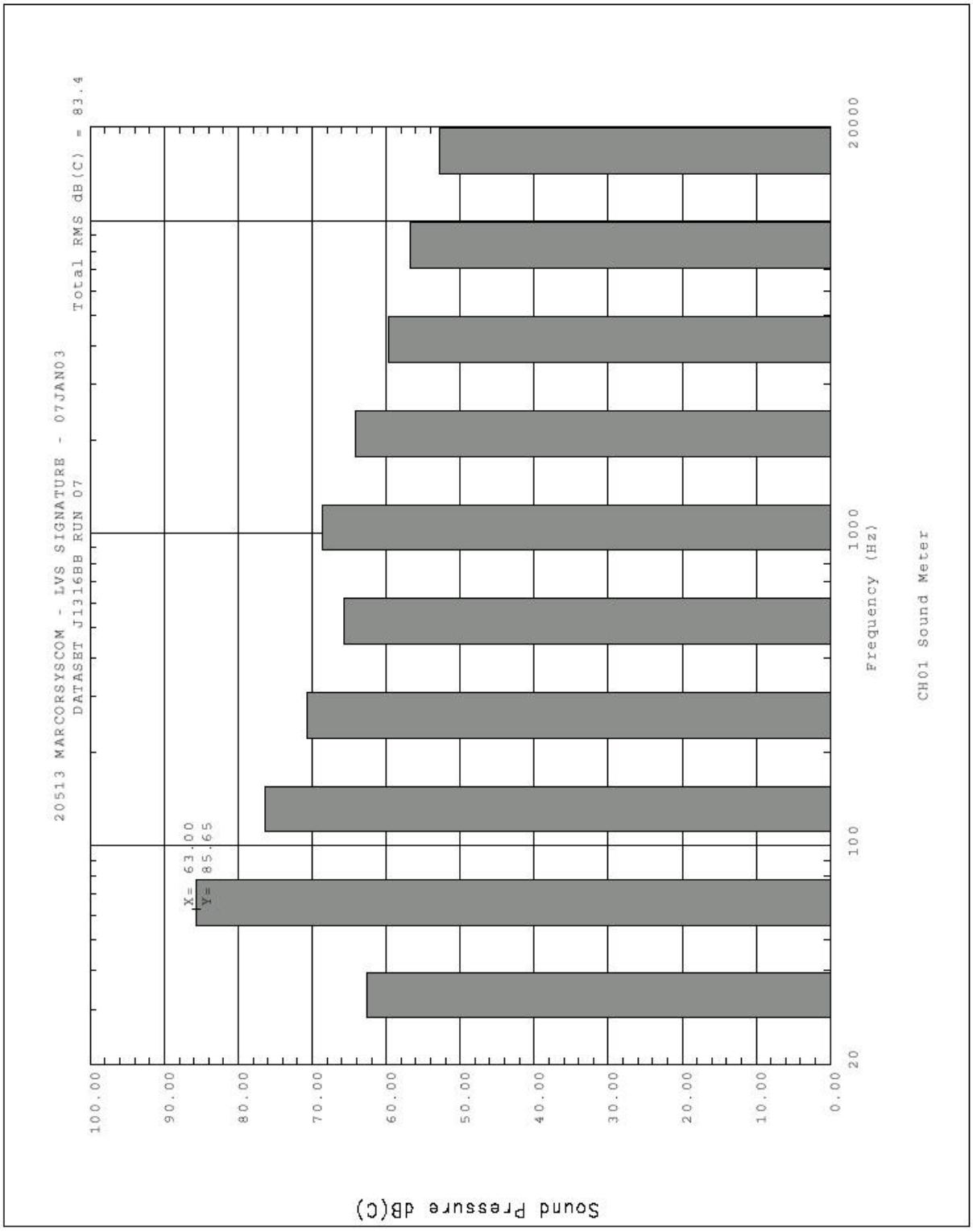
RUN 6
MEASUREMENT IN dB(A)



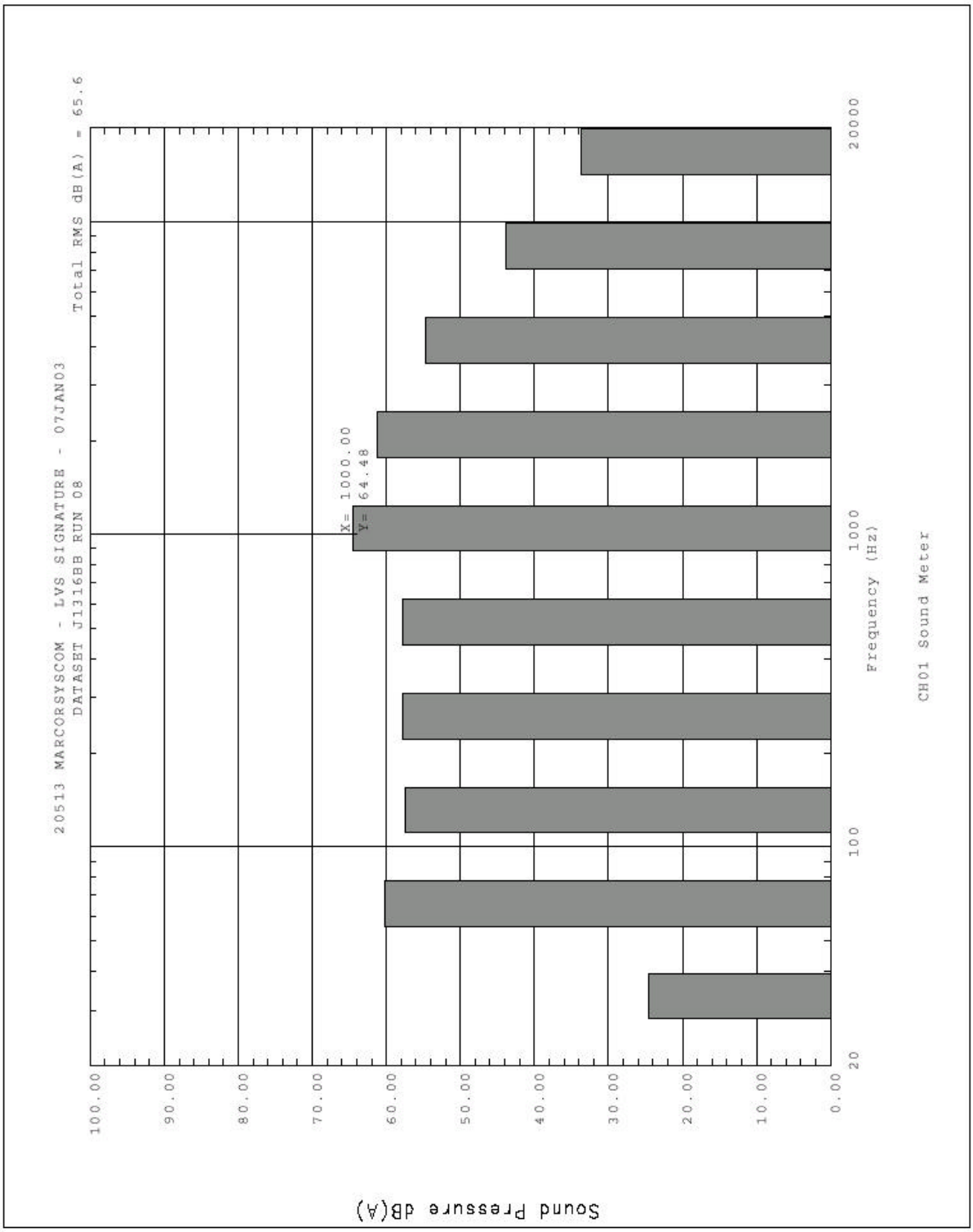
RUN 6
MEASUREMENT IN dB(C)



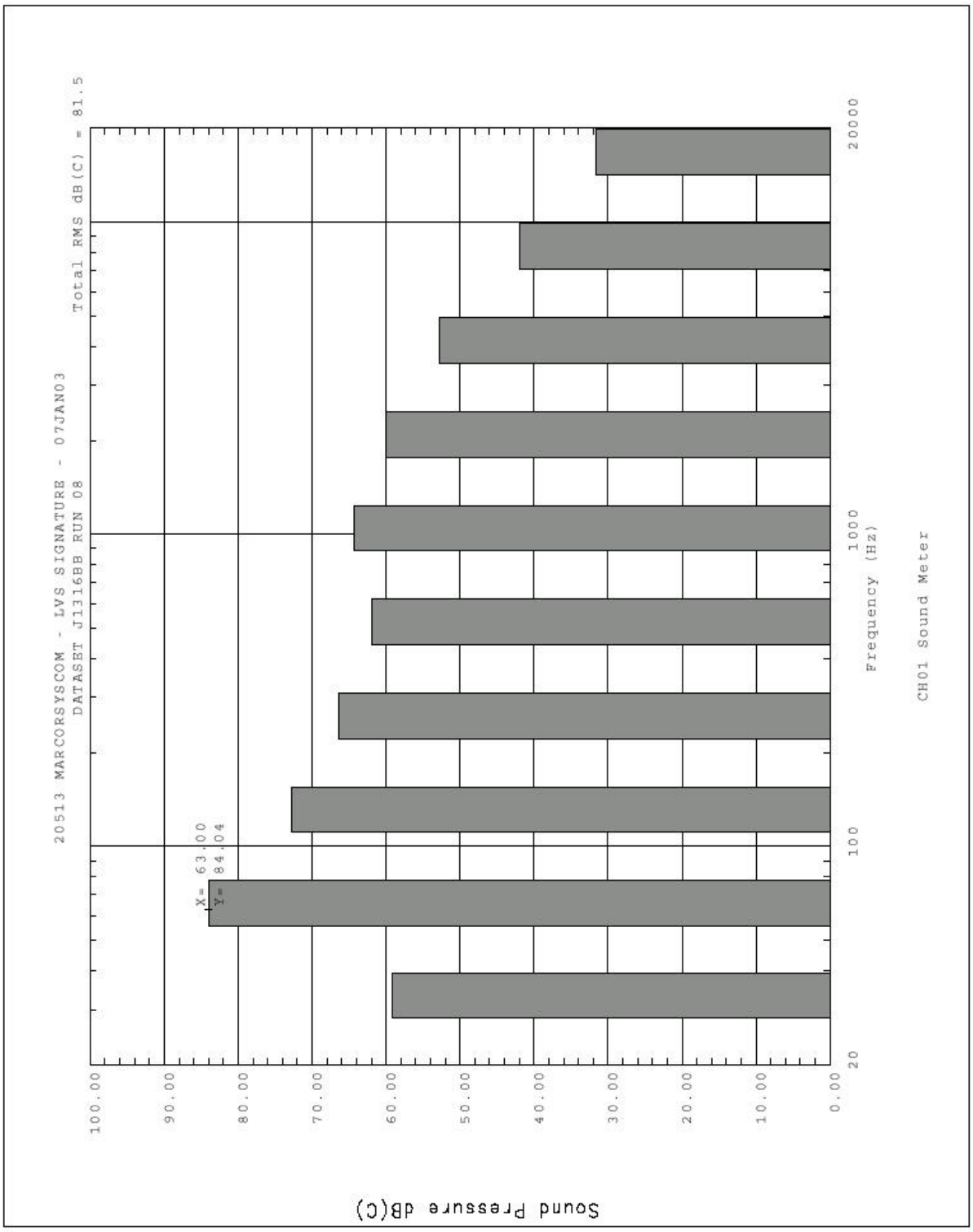
RUN 7
MEASUREMENT IN dB(A)



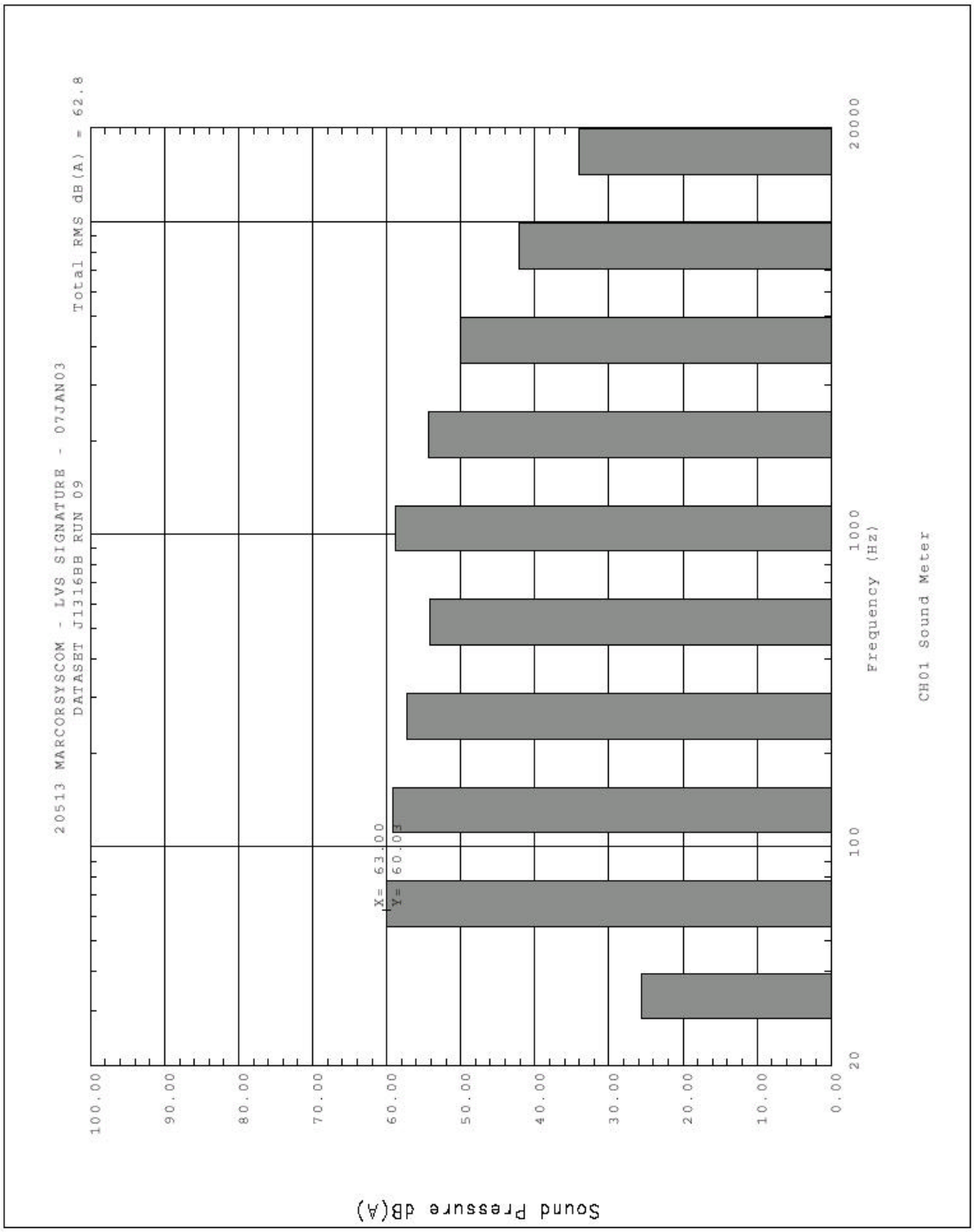
RUN 7
MEASUREMENT IN dB(C)



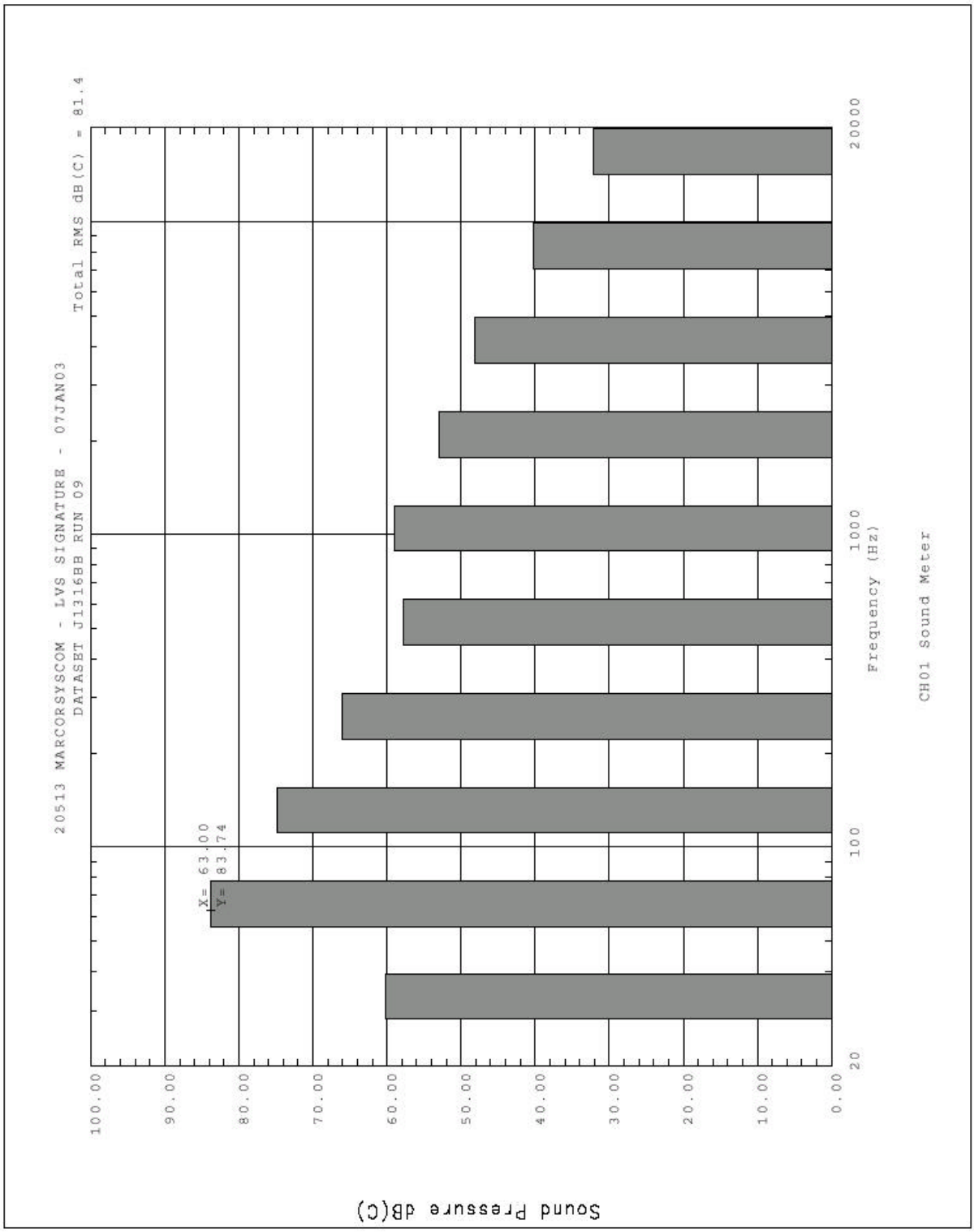
RUN 8
MEASUREMENT IN dB(A)



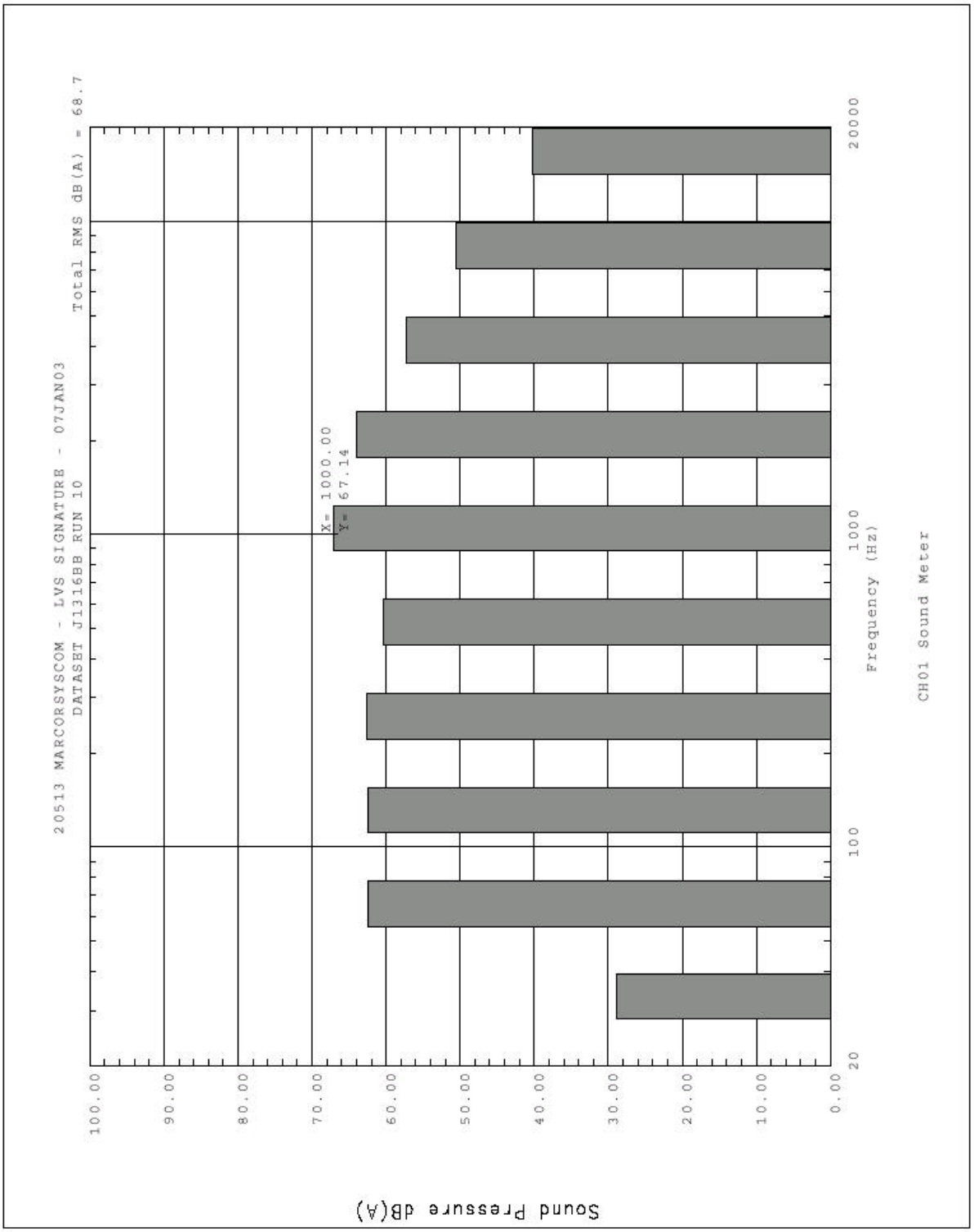
RUN 8
MEASUREMENT IN dB(C)



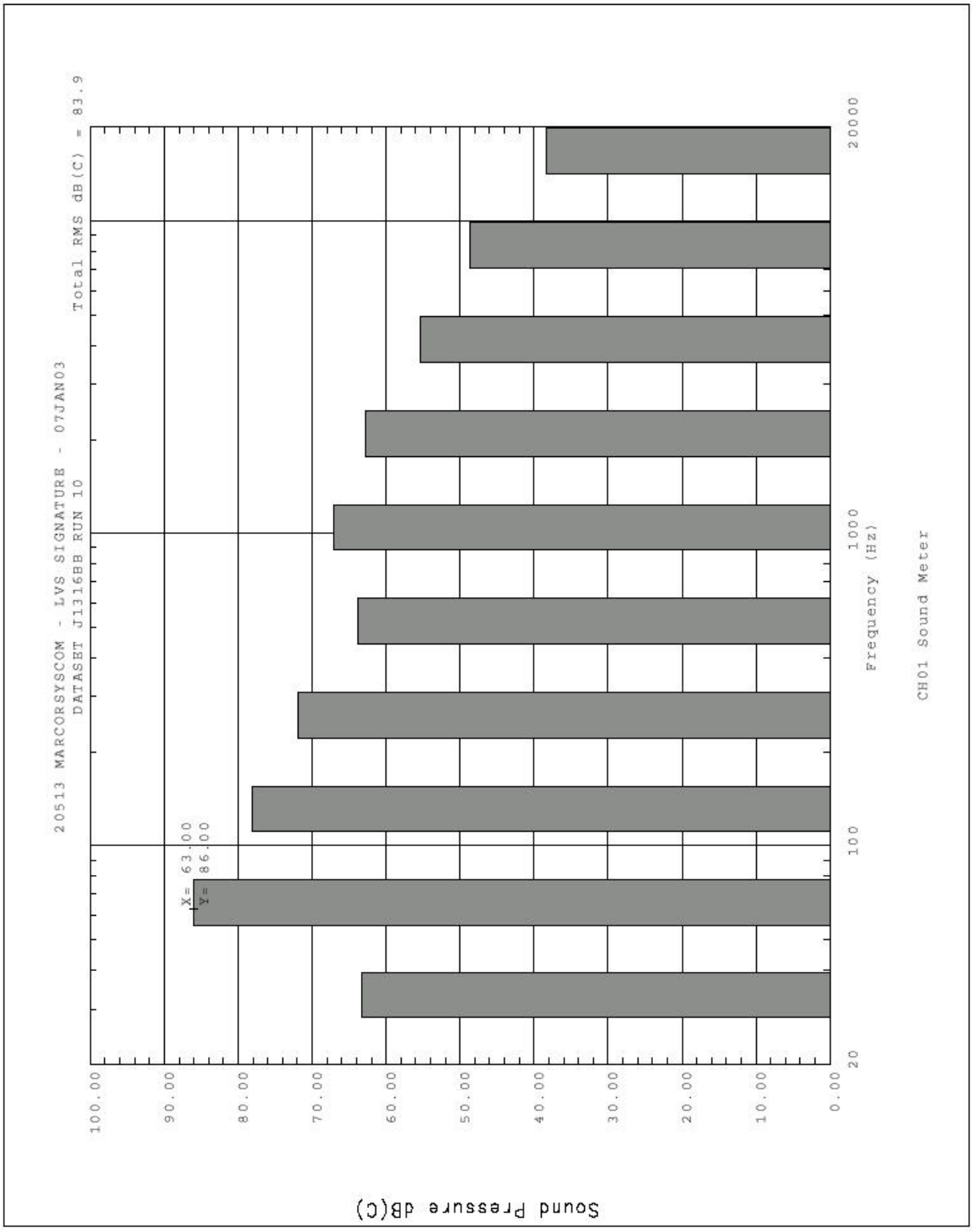
RUN 9
MEASUREMENT IN dB(A)



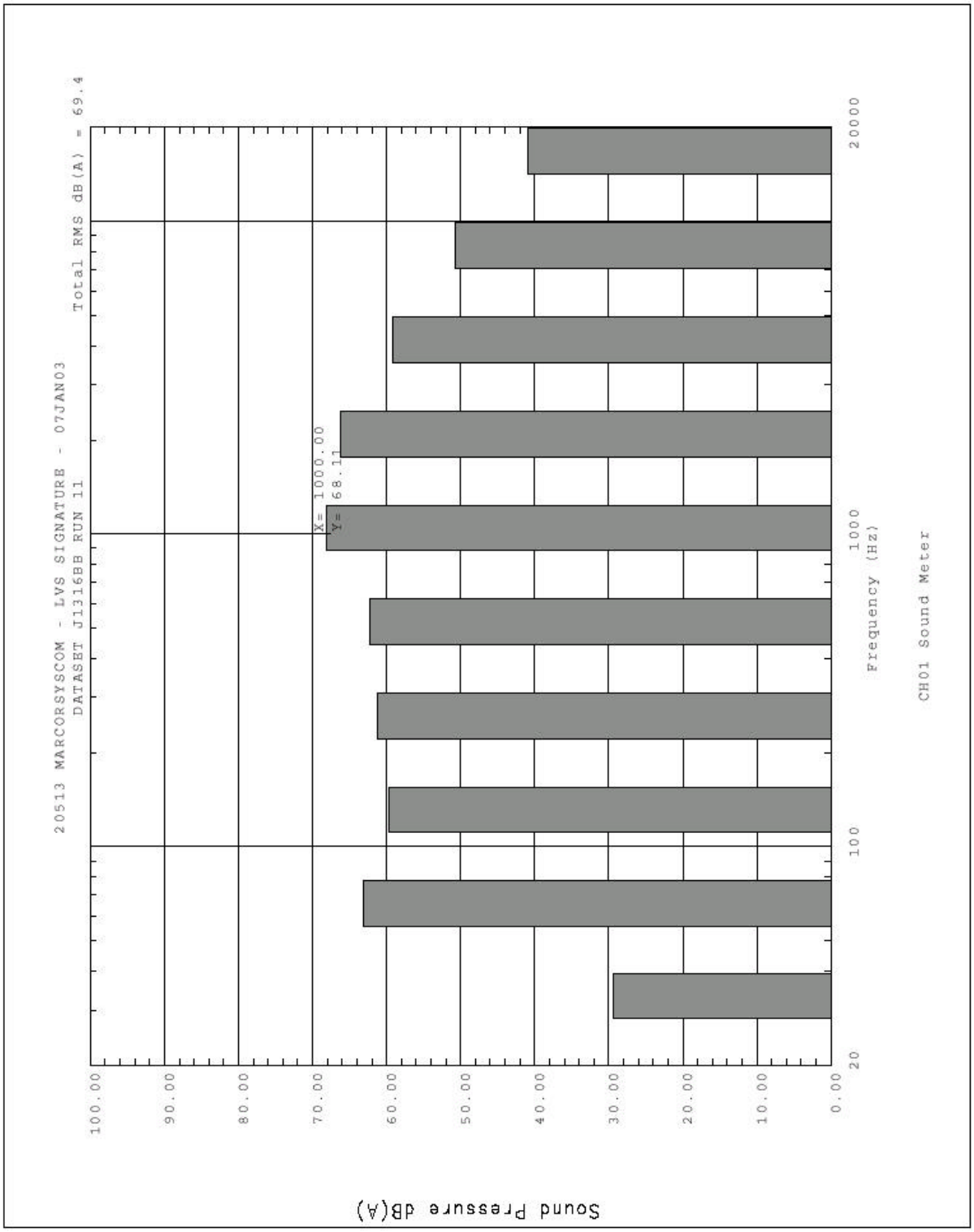
RUN 9
MEASUREMENT IN dB(C)



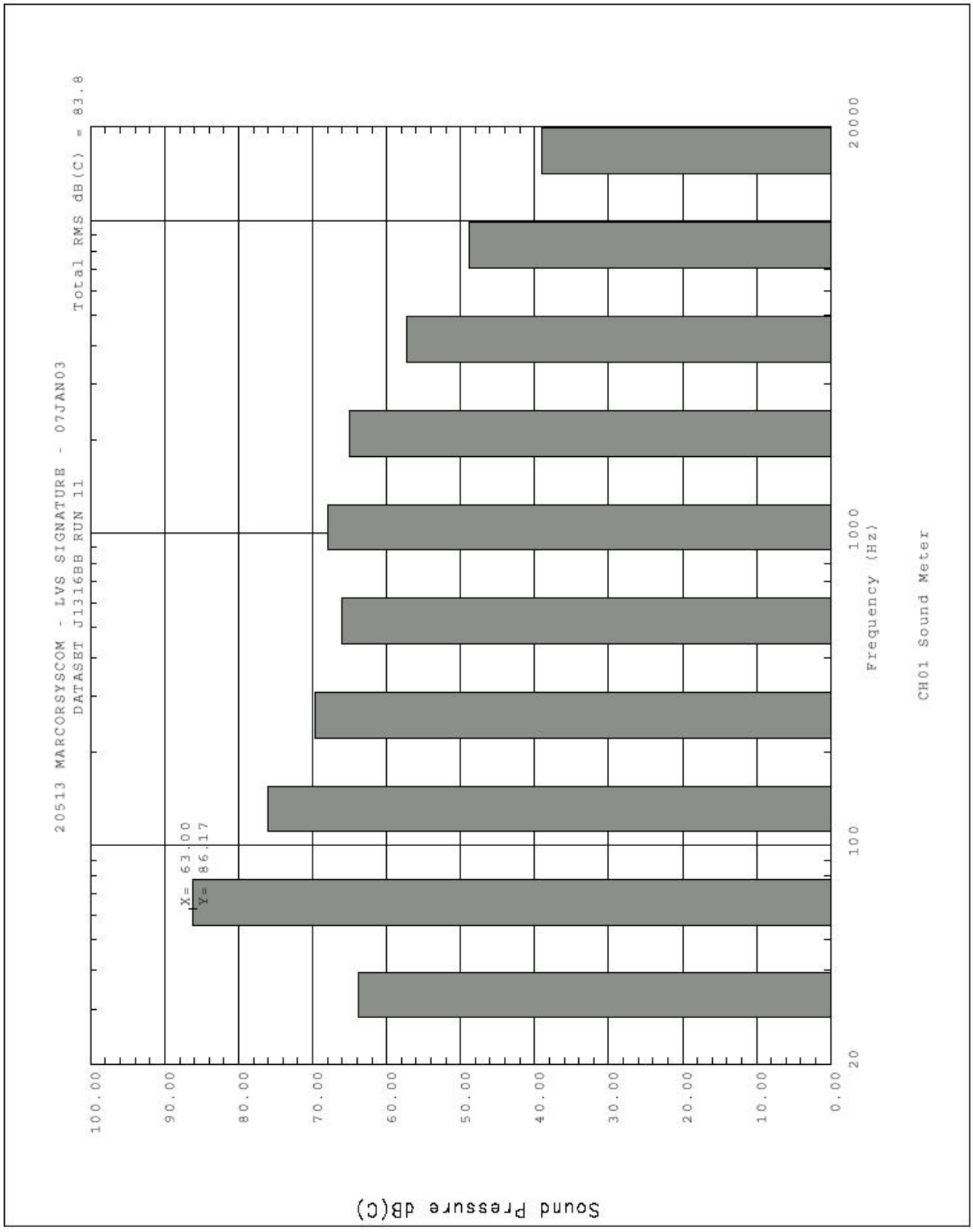
RUN 10
MEASUREMENT IN dB(A)



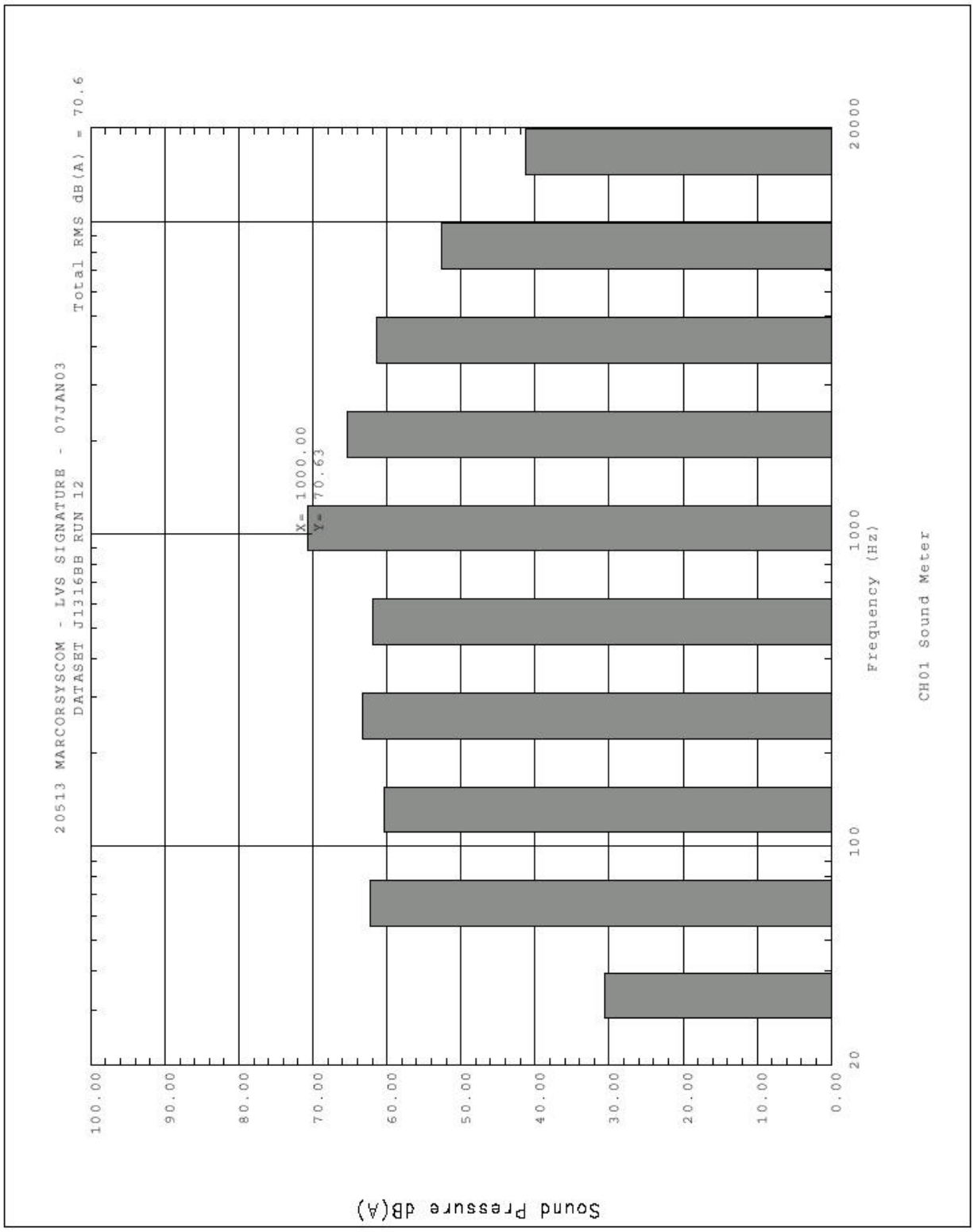
RUN 10
MEASUREMENT IN dB(C)



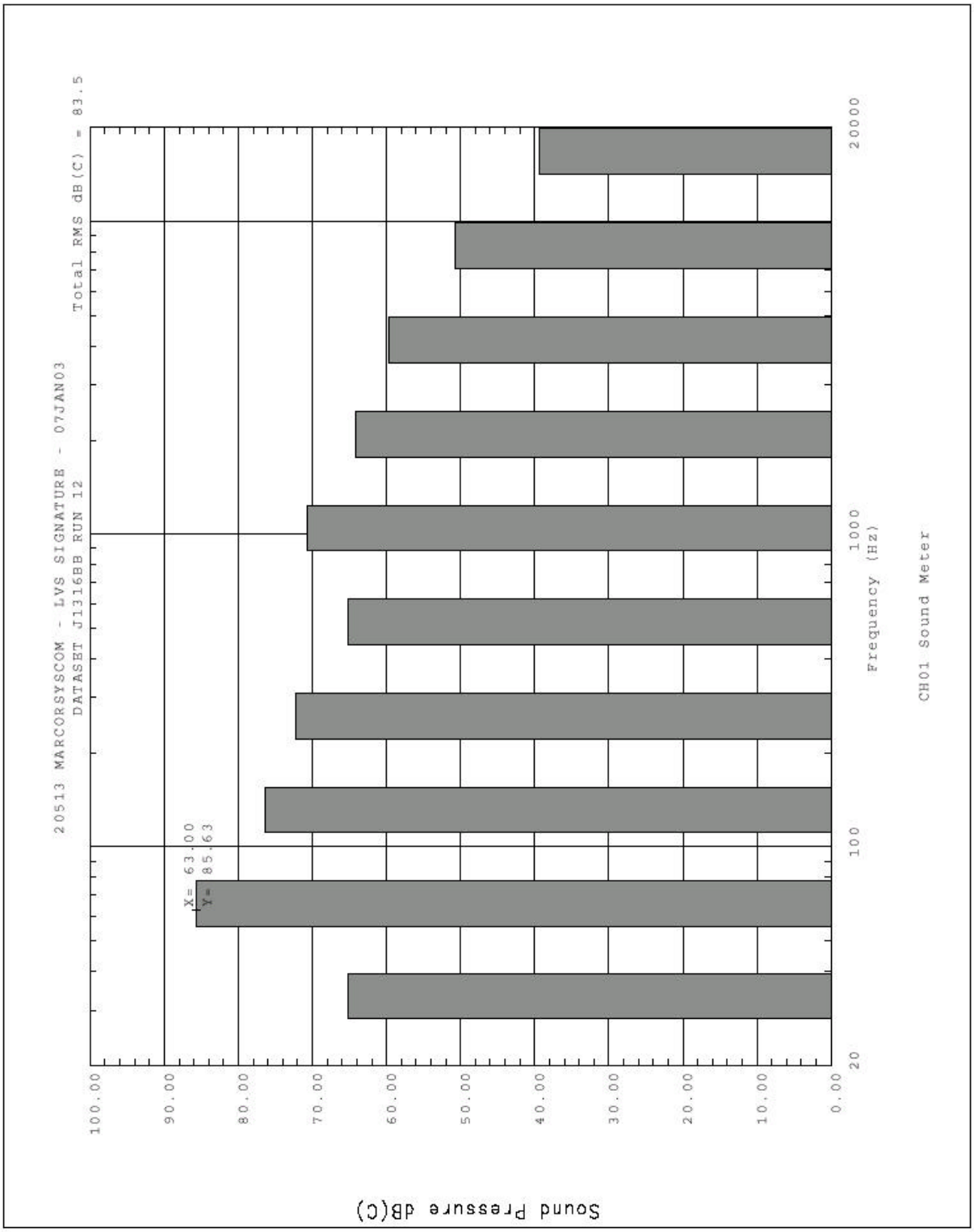
RUN 11
MEASUREMENT IN dB(A)



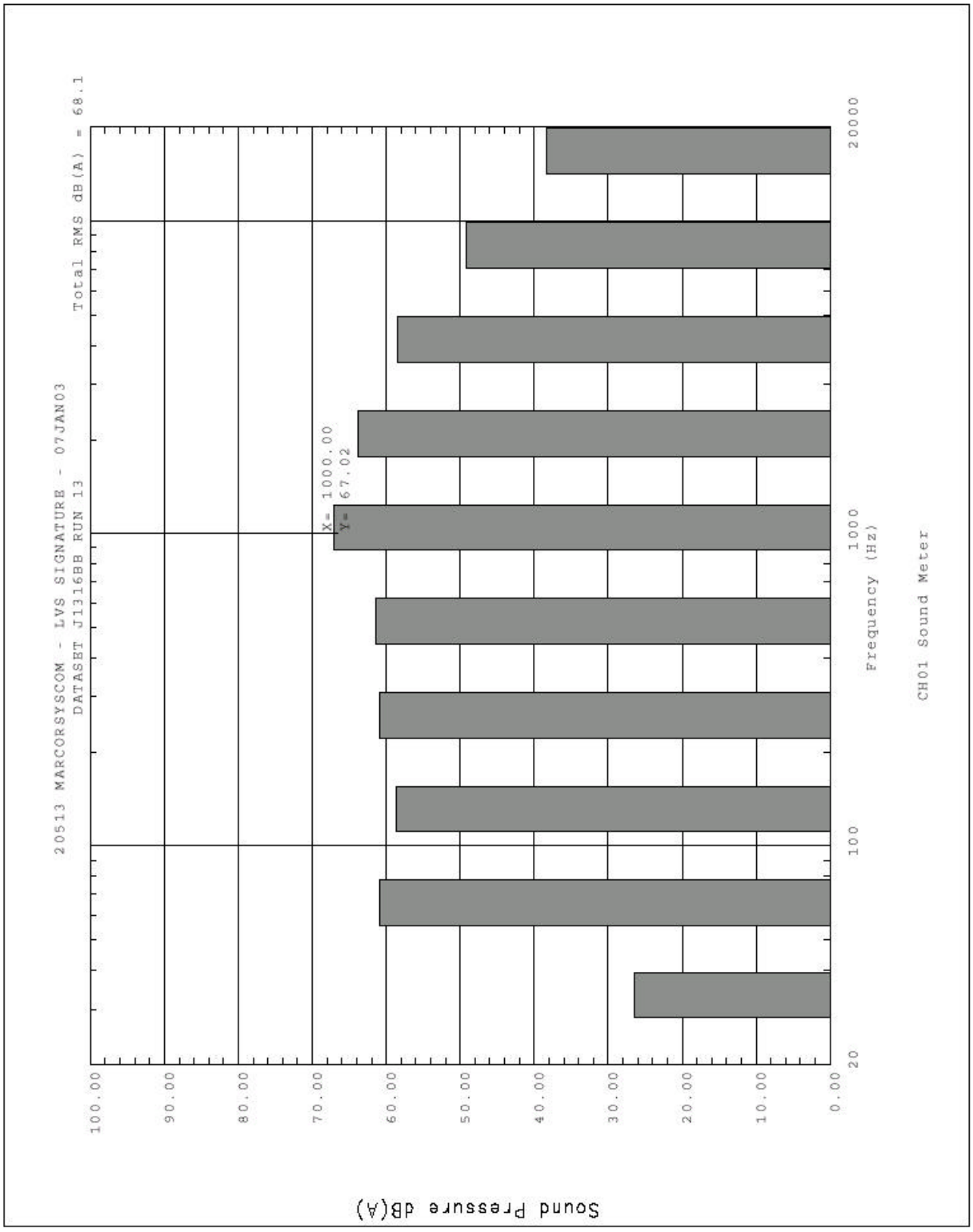
RUN 11
MEASUREMENT IN dB(C)



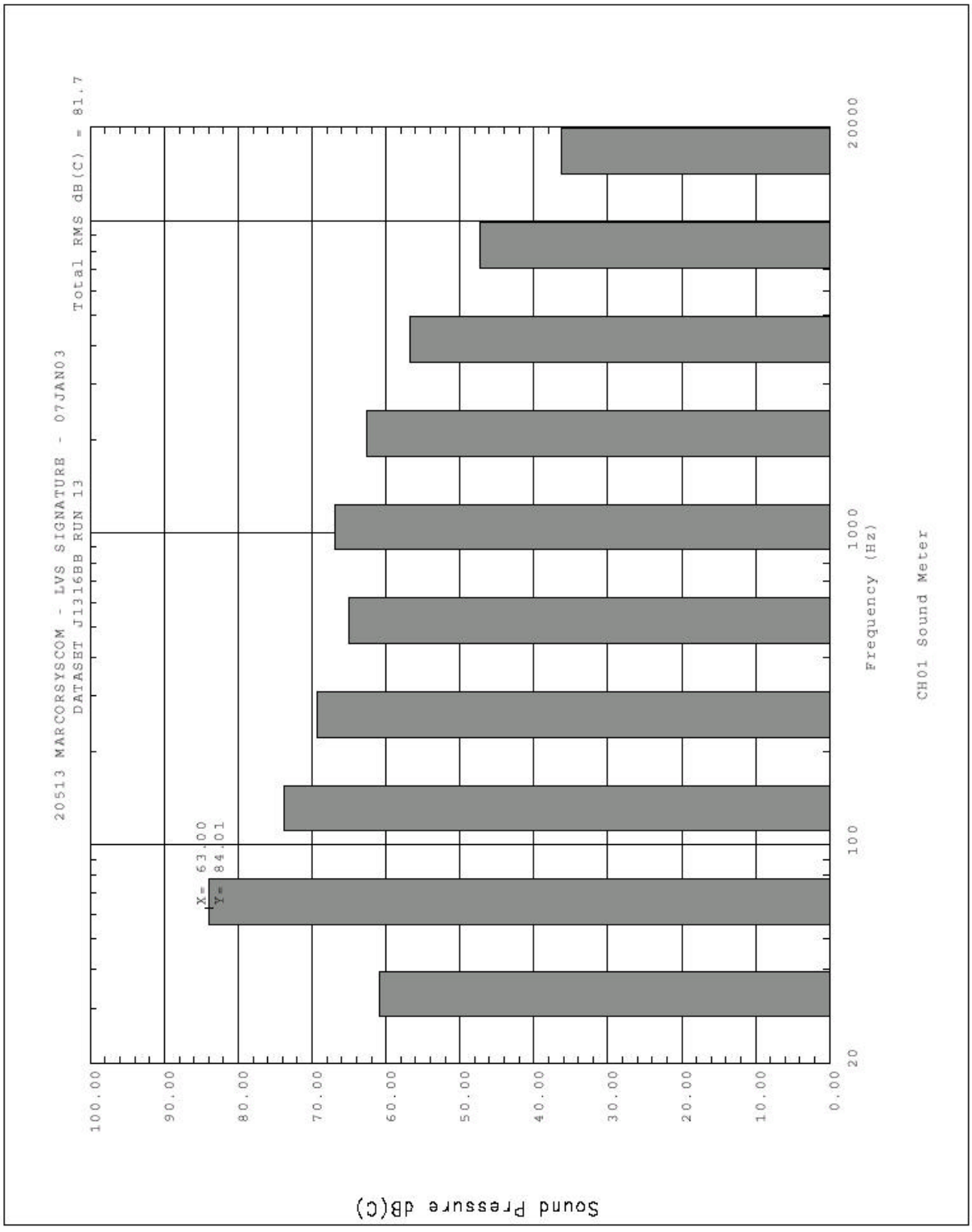
RUN 12
MEASUREMENT IN dB(A)



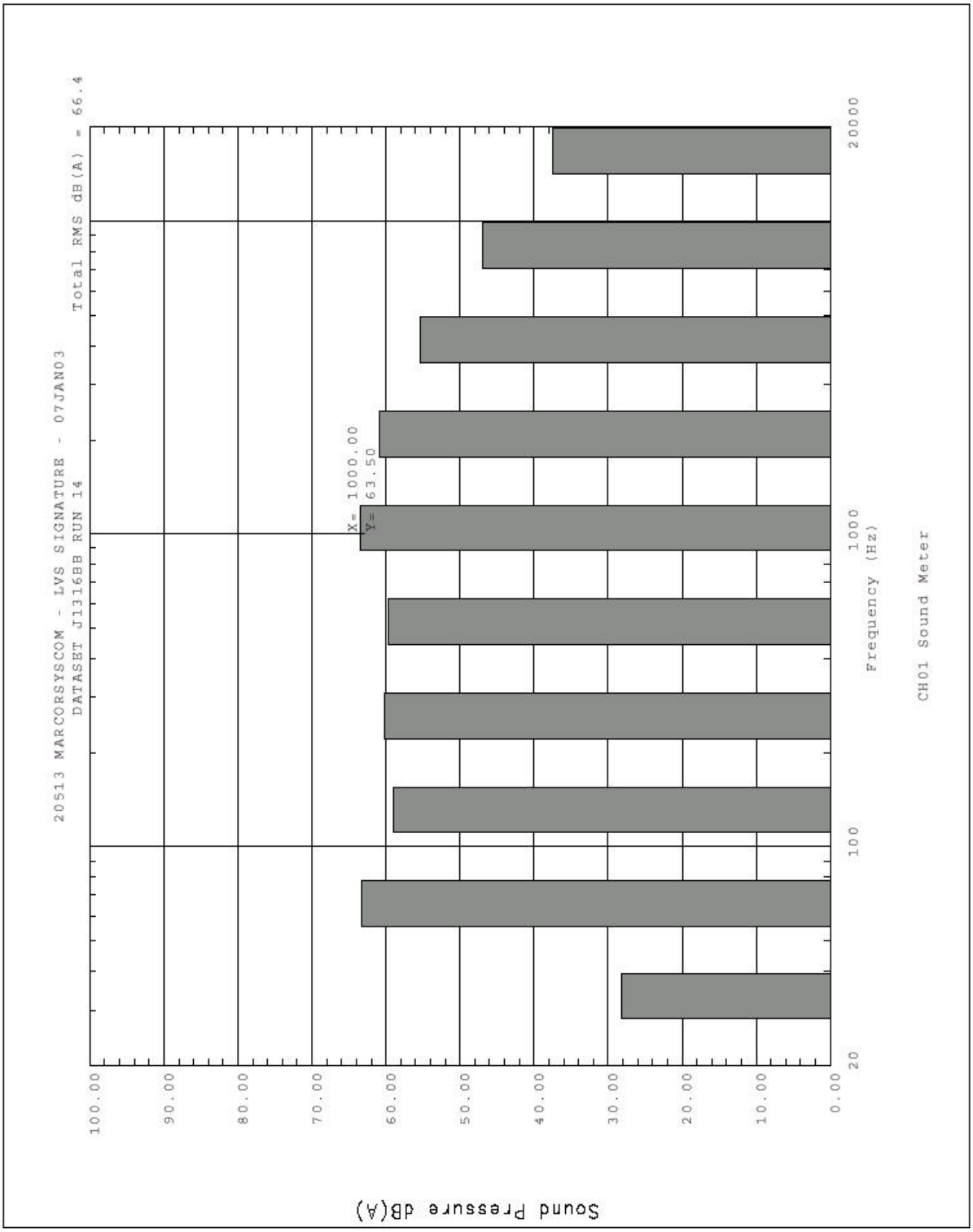
RUN 12
MEASUREMENT IN dB(C)



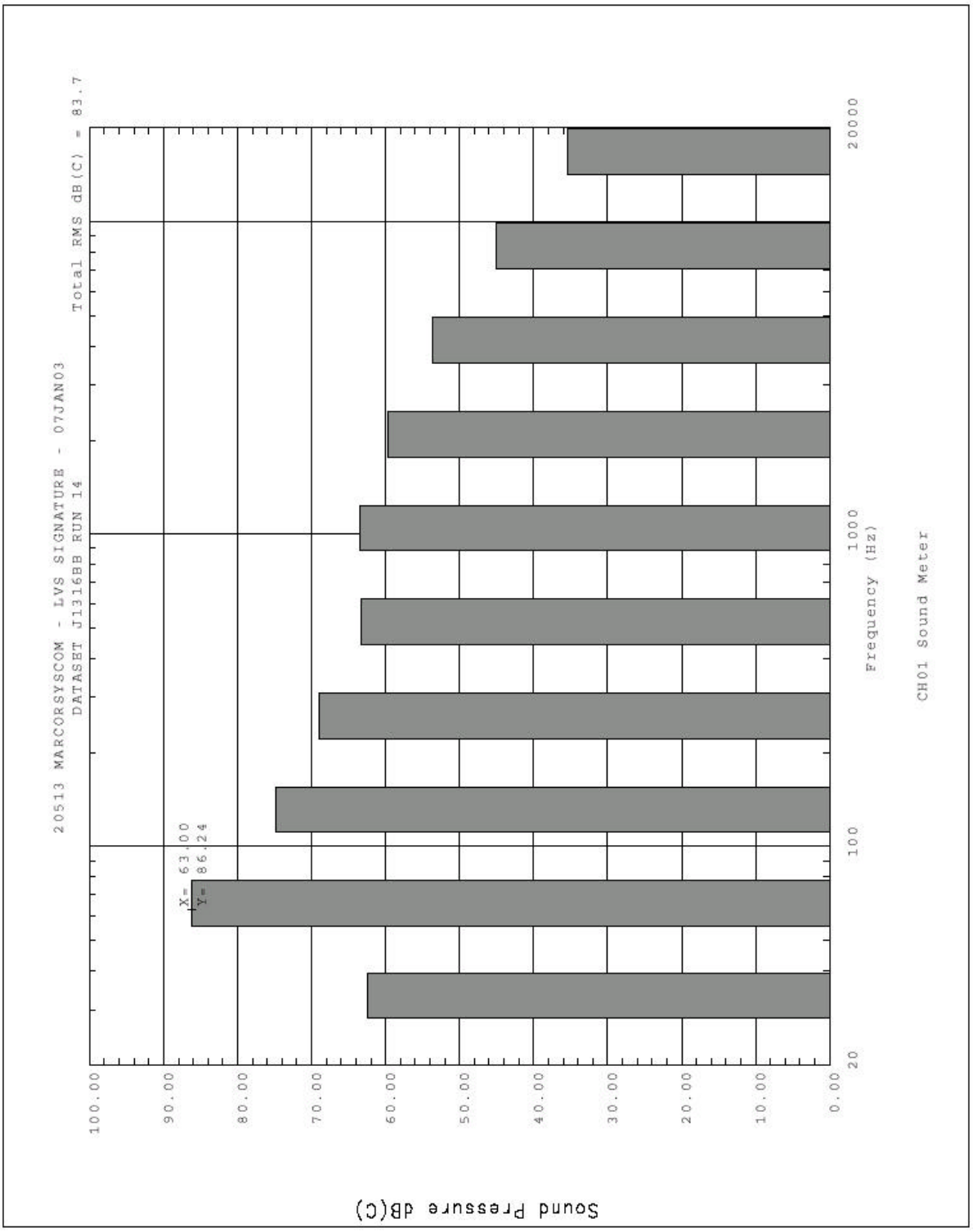
RUN 13
MEASUREMENT IN dB(A)



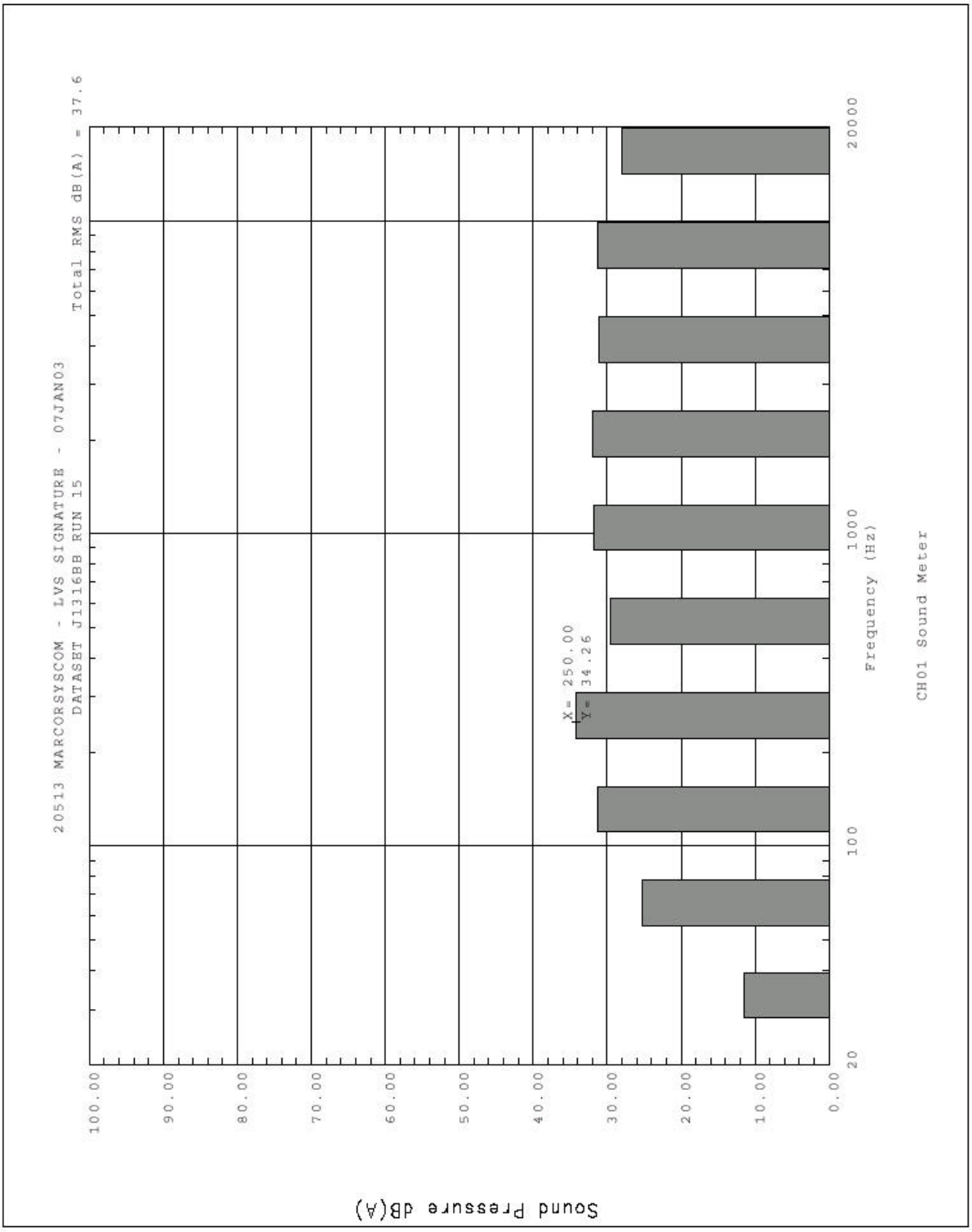
RUN 13
MEASUREMENT IN dB(C)



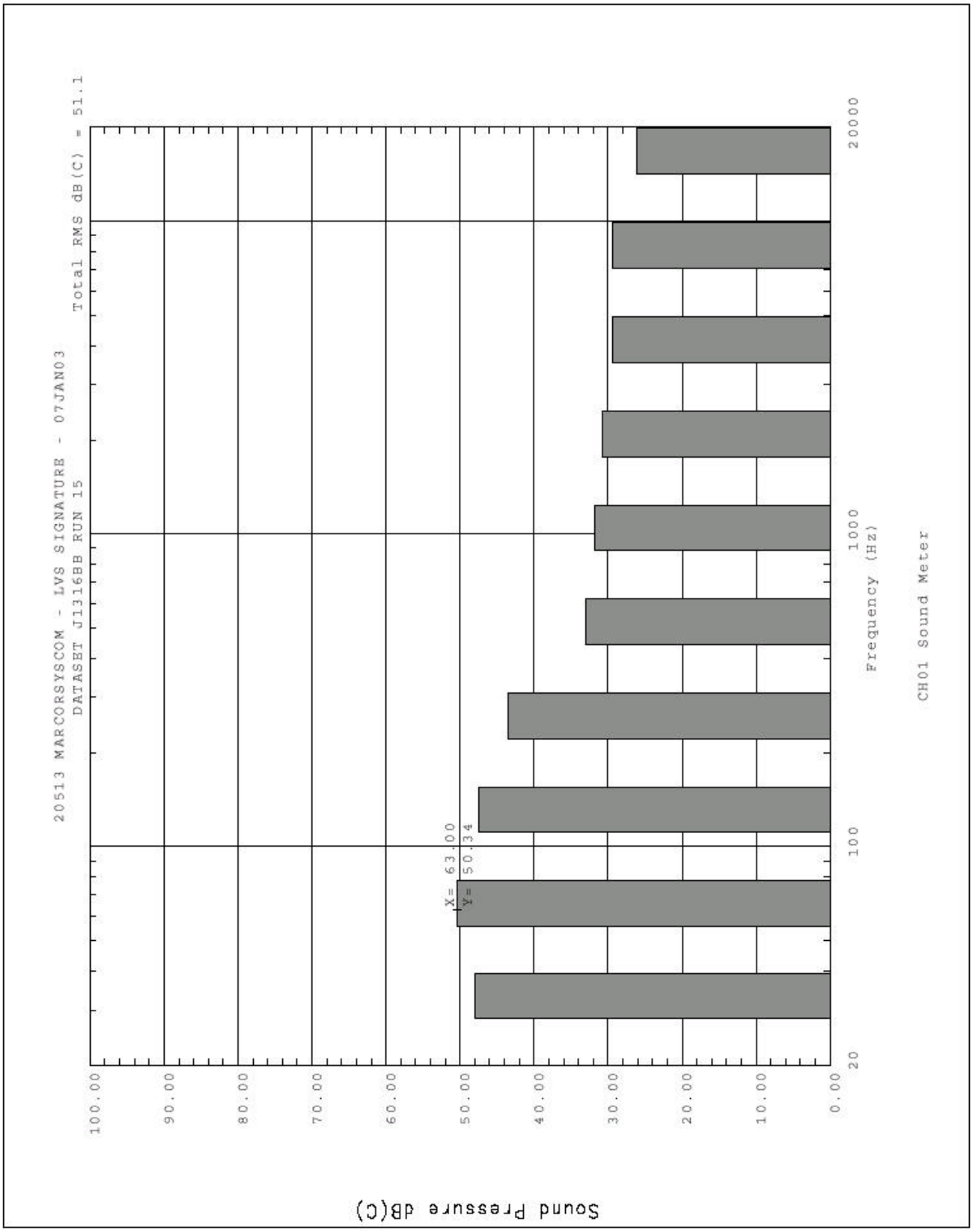
RUN 14
MEASUREMENT IN dB(A)



RUN 14
MEASUREMENT IN dB(C)



RUN 15
MEASUREMENT IN dB(A)



RUN 15
MEASUREMENT IN dB(C)